BULETIN Senggara Fasiliti Jalan

MAC 2008 Suku Tahunan Bil. 1 JKR 20412-0004-08

Pengurusan trafik di tapak bina

Cawangan Senggara Fasiliti Jalan - Peranan & Fungsi

Pengurusan Bencana

MARRIS On-Line

Surface Regularity

Crumb Rubber Modified Bitumen

Cawangan Senggara Fasiliti Jalan, Ibu Pejabat JKR Malaysia, Kuala Lumpur.

Kata-Kata Aluan

Terlebih dahulu saya mengucapkan tahniah di atas penerbitan Buletin Senggara Fasiliti Jalan ini yang julung kali diterbitkan oleh Cawangan Senggara Fasiliti Jalan. Saya melihat penerbitan Buletin ini adalah bagi menyebarkan maklumat, memberi pengetahuan tambahan dalam bidang penyenggaraan jalan, sebagai sumber informasi dan bagi memaparkan aktiviti Cawangan ini dalam pengurusan aset fasiliti jalan khususnya kepada semua warga JKR.

Saya ingin mengambil kesempatan di sini untuk mengutarakan isu pengurusan aset fasiliti jalan. Saya berpendapat kita seharusnya menggunakan pendekatan baru dalam cara kita mengamalkan pengurusan aset tersebut. Apa yang saya maksudkan di sini ialah kita seharusnya perlu mengenal pasti hasil dan impak pengurusan aset yang diamalkan. Proses dan mekanisma yang lengkap perlu disediakan. Selaras dengan ini, Cawangan ini telah pun menyediakan *Standard Operating Procedure* bagi pengurusan aset fasiliti jalan. Di samping itu, Cawangan ini juga sedang dalam proses menyediakan Manual Senggara, mengkaji semula Arahan Teknik berkenaan lampu isyarat, perabut jalan dan sebagainya. Dalam hal ini juga, kita perlu sentiasa menerapkan aspek kualiti dalam kerja penyenggaraan rutin dan berkala. Kita tidak seharusnya lupa bagi memberi tumpuan kepada 'SLRi' iaitu sampah, longkang, rumput dan *inspection*. Saya percaya kesemua ini boleh tercapai dengan menyediakan 'Exception Report' ke atas aset fasiliti dalam koridor jalan.

Bagi memastikan prinsip pengurusan aset dicapai, konsep pengurusan projek telah diterapkan dalam penyenggaraan aset fasiliti jalan, meliputi *Initiation, Planning, Execution, Monitoring & Control, Evaluation* dan *Feedback*.

Menyentuh tema bagi penerbitan Buletin kali ini iaitu Pengurusan Trafik Di Tapak Bina, saya berpendapat selaku *Custodian of Roads*, adalah menjadi tanggungjawab Cawangan ini bagi memastikan rangkaian jalanraya di negara ini sentiasa berada dalam keadaan selamat dan selesa. Ini termasuk aspek keselamatan ke atas pengguna jalanraya dan juga pekerja semasa berada di tapak bina. Melalui pelaksanaan audit secara berterusan ke atas Pelan Pengurusan Trafik di tapak bina, saya percaya kita dapat mengenal pasti kelemahan dan menyarankan penambahbaikan dari semasa ke semasa. Budaya keselamatan sewajarnya dipupuk dan tidak boleh dipandang remeh.

Akhir kata, adalah menjadi harapan saya agar Buletin ini dapat memberi manfaat kepada tuan-tuan semua. Selamat membaca.

Ir. Dr. SAFRY KAMAL HJ. AHMAD
Pengarah
Cawangan Senggara Fasiliti Jalan
Ibu Pejabat JKR Malaysia

Isi Kandungan

Cawangan Senggara Fasiliti Jalan
Peranan & Fungsi

Pengenalan

Selaku "Pemilik Jalanraya" (*Road Custody*), objektif utama Cawangan adalah untuk memastikan fasiliti jalan dalam koridor jalan Persekutuan sentiasa berada dalam keadaan selamat dan andal (*reliable*). Rangkaian jalan perlu disenggara bagi mengoptimakan kos masa perjalanan (*time costs*) dan kos kendalian kenderaan (*vehicle operating costs*). Bagi merealisasi dan mencapai objektif strategi utama Cawangan agar lebih kos efektif, amalan pengurusan aset yang menyeluruh (*total asset management practices*) telah diwujudkan.

Pengurusan aset memerlukan maklumat yang tepat dan dikemaskini berhubung dengan prestasi, keperluan dan kapasiti struktur semua infrastruktur jalan dan jambatan termasuk semua aset yang berada dalam koridor jalan. Ini bermakna keadaan jalan dan struktur dari segi keselamatan hendaklah dipastikan; pengurusan trafik yang sempurna semasa pelaksanaan projek menaiktaraf jalan dan "*structural integrity*" cerun sentiasa dalam keadaan terbaik tanpa berlaku sebarang kemungkinan yang boleh menghalang perjalanan pengguna jalanraya.

Kajian dan pemeriksaan yang kerap bermula daripada proses pembinaan sehinggalah kepada penyerahan dan seterusnya pentauliahan adalah diperlukan bagi memastikan keadaan serta perkhidmatan secara berterusan dapat diberi oleh fasiliti jalan tersebut. Pengurusan aset merangkumi di antaranya aspek-aspek berikut:

i. Mengambilkira pengurusan maklumat data fizikal geometri jalan, cerun dan jambatan.
ii. Mengambilkira sistem pengurusan pavemen dan jambatan terhadap keadaan fizikal dan menjalankan penilaian teknikal dan ekonomik terhadap aset tersebut.
iii. Menjalankan penyenggaraan secara berkala yang berjadual dan bertindak secara "*responsive*".

Strategi Penyenggaraan

Strategi pengurusan fasiliti jalan memerlukan penubuhan sistem penyenggaraan yang optima bagi menilai polisi penyenggaraan dan kesan-kesan ke atas kerosakan pavemen dan kos penyenggaraan. Penilaian lain mengambilkira isu-isu seperti kos kemalangan jalanraya dan alam sekitar (*vehicle emission*).

Menggunakan prinsip pengurusan aset yang bersepadu, tanggungjawab Cawangan ini adalah untuk melaksanakan pengurusan pendaftaran fasiliti serta menjalankan operasi dan penyenggaraan. Di samping itu, Cawangan ini juga memberi perkhidmatan perundingan penyenggaraan serta meneruskan pembangunan kepakaran kejuruteraan senggara fasiliti jalan. Mengaplikasikan prinsip pengurusan projek, penyenggaraan fasiliti menjalankan akitiviti mengikut kitaran penyenggaraan jalan yang ditunjukkan di Rajah 1.0. Ianya meliputi perkara berikut:

i. ***Initiation***: Peringkat ini bermula dengan penetapan polisi penyenggaraan; penyediaan maklumat dan inventori jalan.
ii. ***Planning***: Kewangan yang mencukupi melalui sistem dan proses keutamaan (*prioritisation*), penetapan piawaian dan prosedur.
iii. ***Execution***: Menetapkan program dan melaksanakan kerja penyenggaraan secara berkala dan "*responsive*", menetapkan piawaian dan prosedur untuk diamalkan.
iv. ***Monitoring & Control***: Mengadakan sistem dan mekanisma makluman melalui laporan bulanan dan setiap suku tahun dan pengauditan.
v. ***Evaluation***: Melakukan pemantauan dan penilaian.

Rajah 1.0: Kitaran penyenggaraan jalan.

Pengurusan Pentadbiran & Kewangan

Peranan unit ini adalah merangka dan menggubal polisi-polisi pentadbiran dan kewangan Jalan Persekutuan termasuk mengawal perbelanjaan Belanja Mengurus B27 bagi Jalan Persekutuan seluruh negara.

Peranan ini termasuklah yang dilaksanakan program penyenggaraan yang efektif bagi 22 program penyenggaraan yang berjumlah RM120 juta yang dilaksana oleh JKR Negeri dan Daerah. Melaksanakan program penyenggaraan rutin ke atas 12,000 km Jalan Persekutuan yang berjumlah RM320 juta oleh tiga syarikat konsesi penyenggaraan Jalan Persekutuan yang dilantik, serta program pemulihan jalan berjumlah 600 km dengan nilai kos RM508 juta (lihat Jadual 1.0).

Peranan & Fungsi

BIL	BUTIRAN	JUMLAH (RM)
1	KONSESI	333,804,021.00
2	PROGRAM KHAS JKR NEGERI	114,000,000.00
3	PROGRAM KHAS IP	10,100,000.00
4	PROGRAM KHAS	1,895,979.00

Jadual 1.0: Pembahagian peruntukan tahunan penyenggaraan.

Fokus komponen penyenggaraan tahun 2008 adalah pelaksanaan beberapa program berikut di samping program yang lazim dilaksanakan:

i. Program mengecat garisan jalan.
ii. Program penambaikan papan tanda bagi Negeri Selangor dan beberapa Jalan Utama Persekutuan.
iii. Program menaiktaraf longkang dan sistem pejaritan.
iv. Program menaiktaraf penghadang jalan.

Pewartaan & Pembangunan Tepi Jalan

Unit ini bertanggungjawab mengkaji dan meluluskan permohonan Tanah Kerajaan Dalam Rezab Jalan (kawasan pembangunan), pemasangan paparan iklan dan papan tanda di Jalan Persekutuan. Di samping itu, Unit ini berperanan membuat penilaian dan memberi khidmat nasihat kepada Perbendaharaan berkaitan dengan Geran Jalan Negeri *(State Road Grant)* melalui sistem MARRIS.

Laporan Tahunan Statistik Jalan Persekutuan dan Jalan Negeri bagi seluruh Malaysia disediakan secara tahunan oleh Unit ini. Unit ini turut memberi nasihat berkaitan semua aduan yang diterima dari akhbar, orang awam atau pengurusan atasan JKR dan membuat siasatan ke atas perkara yang bersangkutan dengan aset yang berada dalam koridor jalan.

Peranan Unit ini turut meliputi pemantauan ke atas pemprosesan dokumen pewartaan Jalan Persekutuan di bawah Akta Jalan Persekutuan 1959, di samping memberi nasihat mengenai pengemaskinian dan penyediaan kertas polisi yang bersangkutan dengan Akta Pengangkutan Jalan 1987 di bawah Perintah Sekatan Berat (Jalan Persekutuan) dan memproses permohonan Perintah Had Laju Tempatan (Jalan Persekutuan) serta Perintah Pengangkutan Jalan (Larangan Penggunaan Jalan) berkaitan penutupan jalan dan kelonggan sementara.

Unit ini juga adalah Pengurus Bilik Bencana di peringkat Ibu Pejabat JKR dan berkait rapat dengan Majlis Keselamatan Negara yang menjadi urusetia kepada Jawatankuasa Pengurusan Bencana Pusat.

Kejuruteraan Penilaian & Pemulihan Jalanraya

Unit ini membuat keputusan berkaitan dengan pengurusan dan penyenggaraan Jalan Persekutuan sepanjang 16,500 kilometer menerusi Kontrak Jangka Panjang yang dilaksana oleh tiga syarikat konsesi serta program di luar skop konsesi yang dilaksana oleh JKR Negeri. Ianya termasuk penentuan piawaian, kualiti, prosedur serta pengagihan peruntukan.

Unit ini juga berperanan memberi khidmat nasihat kepada JKR Negeri dan lain-lain agensi kerajaan berhubung dengan penyenggaraan jalan serta memimpin, merancang dan memantau pelaksanaan kerja-kerja penyenggaraan jalan menggunakan teknologi baru. Program-program khusus seperti mengurus dan memantau pelaksanaan program merawat lokasi berbahaya dengan kaedah rawatan kos rendah, penambahbaikan sistem papan tanda arah dan destinasi, dan program mengaudit Pelan Pengurusan Trafik di tapak projek jalan yang dilaksanakan oleh Cawangan Jalan.

Unit ini juga menyediakan maklumbalas kepada pelbagai jawatankuasa luar jabatan mengenai beberapa isu yang bersangkutan dengan penyenggaraan:

i. Mesyuarat Jawatankuasa Tindakan Negara mengenai Pemantauan Projek RMK - 9 (isu penyeragaman papan tanda).
ii. Mesyuarat Jawatankuasa Mengenai Tindakan Keselamatan Jalan di peringkat KSN.
iii. Mesyuarat Bersama Jabatan mengenai isu Pengauditan Papan Tanda.
iv. Maklumbalas Jawatankuasa Kabinet dan Pos - Kabinet.

Di samping itu, Unit ini juga menjalankan kajian bagi tujuan pembangunan dan penyelidikan pavemen jalan untuk pembangunan lestari industri jalan dan kemalangan jalanraya. Unit ini giat melaksanakan beberapa kaedah rawatan seperti CIPR, HIPR, SMA dan sebagainya.

Unit ini telah mewujudkan Jawatankuasa Perantaraan Perindustrian Jalan (Road Industry Interfacing Committee-RIIC) yang berfungsi sebagai penganara di kalangan persatuan-persatuan, syarikat-syarikat serta individu yang terlibat dalam perindustrian jalan.

Pengurusan Pavemen Jalan (RAMS)

Sejajar dengan polisi Jabatan untuk menambahbaik sistem penyampaian, Unit ini telah mengambil tindakan dan inisiatif untuk menubuh sistem pengurusan pavemen dan jambatan. Sistem Pengurusan Aset Jalan telah dibentuk menerusi perisian RAMS-DB/HDM-4 bagi mengenalpasti kerosakan jalan dan menentukan kaedah pembaikan pada Jalanraya Persekutuan secara optima melalui justifikasi teknikal dan ekonomik.

Ianya adalah sistem pengurusan pavemen bagi Jalan Persekutuan secara tahap rangkaian dan analisis projek. Kajian penambahbaikan yang dijalankan telah menghasilkan RAMS (Road Asset Management System) iaitu merangkumi pengkalan data dan inventori jalan dalam format *"Dbase Microsoft Access"* dan HDM-4 sebagai *tool* untuk menjalankan analisis dan penyediaan laporan. Model proses kitaran jangka hayat *(life-cycle modeling)* untuk sesuatu *link* dalam rangkaian jalanraya merangkumi perkara berikut:

i) *"Pavement deterioration model"*.
ii) *"Road user costs analysis"*.
iii) *"Maintenance strategy and optimisation"*.
iv) *"Prioritised Ranking"*.

Struktur Operasi *Road Asset Management System*

HDM-4 meliputi bidang yang luas terdiri dari aspek-aspek perspektif teknikal dan pengurusan. Ianya merangkumi penilaian ke atas model pavemen, kesan kesesakan trafik, keselamatan, *energy* dan *vehicle emissions*, selain dari model

bagi anggaran kos kendalian kenderaan, *road deterioration*, serta kesan kerja pemulihan jalan.

Output adalah dari segi *network level strategy* dan *program analysis*, di samping menjalankan analisis projek.

Strategi Pengutipan Data

Data diperlukan bagi pembentukan sesuatu model untuk meramal keadaan kelakuan (*behavioural condition*) pavemen jalan, termasuk bagi tujuan kalibrasi model yang dihasilkan. Jumlah data yang kecil mengakibatkan model yang dibentuk tidak mempunyai hubungkait yang signifikan dan tidak menggambarkan ciri dan kelakuan yang tepat prestasi pavemen jalan. Manakala jumlah data yang besar akan memerlukan sejumlah kewangan yang amat besar. Secara kasarnya bajet untuk program pengutipan data adalah dalam lingkungan 1.0 - 1.5 peratus bajet penyenggaraan tahunan.

Pengutipan data yang dilaksanakan ke atas Jalan Persekutuan adalah satu pertiga daripada 17,500 km setiap tahun menggunakan peralatan yang sofistikated dikenali sebagai *high speed profilometer* atau *road scanner*. Data pavemen diperolehi dalam segmen setiap 1 km seksyen secara kitaran tiga tahun dan dibahagikan kepada tiga zon:

i) Negeri-negeri utara iaitu Perlis, Pulau Pinang, Kedah, Perak dan Selangor.
ii) Negeri-negeri selatan iaitu Negeri Sembilan, Melaka, Johor, Sabah, Sarawak dan Labuan.
iii) Negeri-negeri di pantai timur iaitu Kelantan, Terengganu dan Pahang.

Alat *profilometer* kelajuan tinggi mengutip maklumat seperti *"rut depth"*, *"texture depth"*, *"roughness"*, *"cracks"*, *"potholes"*, *"profiles longitudinal"* dan *"road alignment"* serta mencerap ukuran pada satu masa menggunakan alat perakam video dan melalui sistem sensors, seperti *"inclinometer"* dan *"transducers"*.

Keadaan struktur pavemen diperolehi menggunakan FWD (*falling weight deflectometer*). Ketebalan pavemen dikenalpasti menggunakan *"Dynamic Cone Penetration"* untuk mendapatkan *"Subgrade modulus"*. Bancian had beban gandar diguna untuk memantau peningkatan bilangan gandar bagi mendapatkan faktor kerosakan pavemen bagi sesuatu tempuh.

Maklumat yang diperolehi dipopulasikan ke dalam sistem RAMS/HDM4 untuk mendapatkan keadaan keseluruhan Jalan Persekutuan. Parameter seperti *"roughness"*, *"cracking"*, *"rut depth"*, dan *"texture depth"* dianalisis dan dilaporkan sebagai purata keadaan rangkaian jalanraya.

Pengurusan & Pemulihan Jambatan

Unit ini memantau supaya semua jambatan disenggara dalam keadaan yang baik dan selamat digunakan. Pengurusan pengkalan data JKR-BMS dikendalikan supaya maklumat stok jambatan sentiasa dikumpul, direkod dan dikemaskini selaras dengan pelaksanaan program penyenggaraan secara sistematik.

Unit ini menjadi penasihat kepada Urusetia Penganjur Kursus tahunan mengenai teknik pemeriksaan, penyenggaraan dan kaedah baikpulih jambatan kepada JKR Negeri dan Daerah yang dilakukan pada bulan Jun / Julai setiap tahun.

Pemantauan dilakukan dengan melakukan pemeriksaan pengesahan ke atas jambatan yang diperiksa dan yang dilaporkan rosak dengan kategori *condition rating* 4 atau 5 oleh JKR Daerah mengikut Program Pemeriksaan Mandatori Tahunan Jambatan.

Pemeriksaan jambatan dijalankan untuk menyedia anggaran kos, skop kerja serta pengesyoran cadangan penyenggaraan, menaiktaraf, pelebaran, penggantian jambatan dan sebagainya. Pemeriksaan terperinci ke atas jambatan yang rosak kritikal/luarbiasa, bencana banjir, kecemasan dan penilaian struktur jambatan sentiasa dilakukan.

Unit ini memimpin kajian jambatan dari masa ke semasa termasuk penggunaan aplikasi/kaedah bahan-bahan dan teknik-teknik penyenggaraan jambatan. Di samping itu, khidmat nasihat dan panduan teknikal diberi kepada JKR Daerah/Negeri dan lain-lain agensi mengenai penyenggaraan jambatan.

Unit ini juga melaksanakan pemeriksaan jambatan bagi tujuan penyerahan projek jambatan, jejantas dan jejambat yang siap dibina dan menyimpan semua rekod inventori, lukisan *as-built* dan jaminan produk yang diterima dari Pegawai Penguasa projek-projek berkenaan.

Pemantauan pelaksanaan projek jejantas dan juga projek menggantikan jambatan rosak akibat bencana banjir adalah di bawah pengendalian Unit ini.

Perkhidmatan Mekanikal

Unit ini memastikan penyenggaraan kenderaan-kenderaan Jabatan di bawah kawalannya berada dalam keadaan baik dan memberi khidmat nasihat bagi penyenggaraan peralatan mekanikal pada rangkaian Jalan Persekutuan termasuk perkhidmatan Feri Pengkalan Kuboc.

Perkhidmatan Elektrikal

Di antara fungsi utama Unit ini adalah memastikan kerja penyenggaraan lampu jalan dan lampu isyarat dilaksana berteraskan spesifikasi piawai yang ditetapkan secara berterusan demi keselamatan dan kesetesaan pengguna jalanraya. Maklumat dan data seperti pemasangan sedia ada, pemasangan projek baru dan aduan kerosakan dikumpul, di samping memberikan khidmat kepakaran teknikal untuk pemasangan elektrik bagi sistem lampu jalan dan lampu isyarat.

Pengumpulan data maklumat mengenai inventori lampu jalan dan bilangan lampu isyarat persimpangan dilakukan dari masa ke semasa supaya perancangan dapat dibuat bagi menyediakan program tahunan penyenggaraan lampu jalan dan lampu isyarat. Mekanisma dibentuk supaya laporan mengenai kerosakan lampu jalan dan lampu isyarat sampai ke

Ibu Pejabat bagi membolehkan tindakan diambil untuk membaiki kerosakan ke atas aset tersebut.

Pengurusan Penyenggaraan Jalanraya (Zon Utara, Tengah/Timur & Selatan)

Bagi menyelaras keperluan penyenggaraan - mengikut perjanjian konsesi Jalan Persekutuan dan di luar skop konsesi di antara JKR Negeri dan JKR Daerah, Unit Pengurusan Penyenggaran Jalan peringkat zon telah ditubuhkan di bawah pentadbiran Cawangan Senggara Fasiliti Jalan.

Unit ini dipertanggungjawab untuk memantau kerja senggara rutin, kerja berkala pavemen, berkala bukan pavemen dan kerja kecemasan di bawah program Kontrak Jangka Panjang Penyelenggaraan Jalan Persekutuan termasuk memperaku bayaran ke atas kerja-kerja yang dilaksanakan oleh tiga syarikat konsesi mengikut pecahan zon. Ini termasuk memantau penyelarasan aduan mengenai penyenggaraan Jalan Persekutuan dan aduan kerosakan.

Kejuruteraan Geoinformatik

Tanggungjawab Unit Kejuruteraan Geoinformatik adalah untuk merancang, membangun, melaksana dan menyenggara Sistem Maklumat Geografik (GIS) bagi Jalan Persekutuan dan Jalan Negeri berserta aset jalan iaitu jambatan, papan tanda dan "km posts" dalam digital untuk digunakan dalam pengurusan inventori dan analisa penyenggaraan jalan dan aset jalan, perancangan dan penentuan jajaran jalan baru, penerbitan peta jalan JKR (*hardcopy*), pemetaan rangkaian jalan JKR di Semenanjung Malaysia dan Labuan, pemetaan lokasi kemalangan, lokasi banjir, lokasi projek jalan, lokasi jalan yang diwartakan dan memproses penilaian maklumat pembangunan tepi jalan.

Unit ini juga bertanggungjawab mengurus maklumat imej satelit, cerapan maklumat jalan dan aset jalan menggunakan peralatan *'Global Positioning System'* (GPS), maklumat digital lot tanah, maklumat peta topo di mana maklumat ini digunakan oleh perekabentuk jalan, Cawangan Jalan.

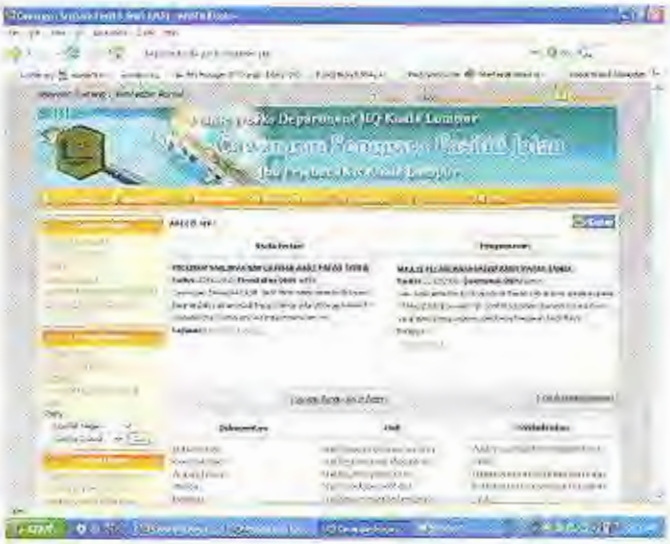
JKR telah diiantik sebagai *data custodian* dan *lead agency* (Agensi Tunjak) bagi maklumat jalan dan aset jalan dan jambatan melalui Pekeliling 1/97 dan *Malaysia Centre Geospatial Data Infrastructure* (MaCGDI) di bawah Kementerian Sumber Asli telah dipertanggungjawabkan untuk menguruskan maklumat Geospatial (iaitu maklumat yang mempunyai koordinat) di peringkat kebangsaan.

JKR juga telah dikenalpasti sebagai data *custodian* untuk maklumat geoteknik dan bangunan. Cawangan Senggara Fasiliti Jalan (CSFJ) membekal data digital rangkaian jalan dan aset jalan / jambatan / geoteknik kepada MaCGDI bagi tujuan pembangunan data *geospatial* di peringkat nasional.

CSFJ bertanggungjawab menyimpan dan mengurus maklumat *as-built drawing* semua projek-projek jalan JKR untuk tujuan penyenggaraan. Maklumat *as-built drawing* adalah dalam bentuk digital dan mempunyai koordinat (x, y, z) bagi setiap aset dalam lukisan tersebut. Dengan menggunakan sistem maklumat geografi, maklumat lukisan ini digunakan dalam pengurusan inventori asset dan penyenggaraan dan ia adalah lebih efisyen, ekonomikal, berkualiti (kerana maklumat diukurhalus oleh jurukur bertauliah), lebih selamat (simpan dalam server/CD/DVD), mudah dicapai dan menjimatkan masa.

Produk Sistem Maklumat Geografi (GIS)

Pembangunan Laman Web Cawangan Senggara Fasiliti Jalan

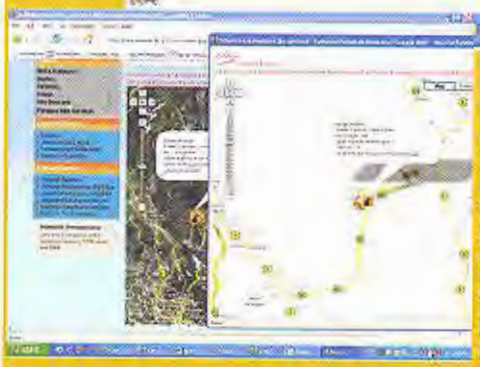


Unit Kejuruteraan Geoinformatik (GIS) telah membangunkan Laman Web Cawangan Senggara Fasiliti Jalan. Sila layari http://rakanI.jkr.gov.my/csfj.

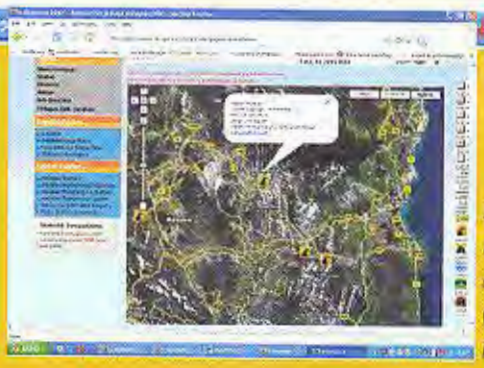
Aplikasi GIS dalam Laman Web Bencana Alam

Laman Web Bencana Alam atau e-Bencana Alam telah menggunakan teknologi Sistem Maklumat Geografi (GIS) untuk memaparkan lokasi berlaku bencana seperti tanah runtuh, kawasan banjir dan laluan alternatif berlatarbelakang maklumat *Google Map*.

Laman e-Bencana Alam.



Laluan alternatif (bertanda merah) semasa berlaku sesuatu bencana ditandakan di Google Map oleh pegawai JKR yang bertugas.



Lokasi tanah runtuh dipaparkan di Google Map (pilih Hybrid untuk lihat imej satelit).

Pembangunan Aplikasi GIS di Cawangan Senggara Fasiliti Jalan

Paparan maklumat spatial (berkordinat x,y) menggunakan web-based GIS. Negeri Selangor telah dijadikan perintis untuk paparan maklumat.

A. Maklumat yang dipaparkan ialah:
http://172.20.1.226/Road_Furniture/default.aspx (Editing online)
http://172.20.1.226/Selangor/default.aspx (view sahaja)

a. Rangkaian Jalan Utama Jalan Persekutuan dan Jalan Negeri Semenanjung Malaysia.
b. Papan Tanda, Km Posts dan Jambatan Jalan Persekutuan.
c. Lampu Jalan/Trafik Jalan Negeri.
d. Penghadang Jalan dan Longkang Jalan Negeri.

B. Maklumat yang boleh dikemaskini secara 'online'(anggota GIS sahaja) ialah:

a. Maklumat Borehole http://172.20.1.226/geoteknik/default.aspx
b. Blackspot http://172.20.1.226/accident/default.aspx
c. Lokasi Banjir http://172.20.1.226/Flood/default.aspx
d. Lokasi Jalan (Pewartaan) http://172.20.1.226 Road_Gazette/default.aspx
e. Lokasi PTJ http://172.20.1.226/Road_Site_Development/default.aspx

Kawalan trafik di tapak bina

By Ir. Mohd Hizam Harun & Jazlina Nor Sarif

Menurut Arahan Teknik (Jalan) 2C/85, kerja-kerja yang bersifat sementara seperti pembinaan dan penyenggaraan jalan menyediakan persekitaran jalan yang berbeza dari kebiasaannya di mana pengguna jalanraya akan berdepan dengan keadaan trafik yang tidak dijangka. Ini bukan sahaja boleh membahayakan pengguna jalanraya malah pekerja itu sendiri sekiranya langkah-langkah keselamatan tidak diambil. Penggunaan papan tanda sementara di 'zon kawalan trafik' adalah satu kemestian bagi memaklumkan kepada pengguna jalanraya mengenai sebarang kemungkinan yang akan dihadapi semasa kerja – kerja pembinaan atau penyenggaraan jalan sedang dilaksanakan. Papan tanda sementara sewajarnya diletakkan di lokasi tertentu di mana ia dapat memaparkan maklumat dengan berkesan dan memberi masa yang secukupnya kepada pengguna jalanraya untuk bertindak dengan sewajarnya. Zon kawalan trafik terletak di antara papan tanda amaran yang pertama sehingga ke lokasi di mana trafik tidak lagi terganggu oleh aktiviti kerja. Peralatan yang biasa digunakan bagi mengawal pergerakan trafik ialah papan tanda, kon keselamatan, *barrier, delineator* dan sebagainya.

Berikut disenaraikan peringatan penting semasa merancang, melaksana dan menyelenggara zon kawalan trafik:

1. Utamakan keselamatan. Gunakan kawalan yang sewajarnya bagi memastikan pengguna jalanraya dan pekerja sentiasa selamat.
2. Papan tanda mesti dapat dilihat dengan jelas bagi membolehkan pengguna jalanraya mematuhinya. Besarkan papan tanda atau letakkan di tempat yang lebih tinggi supaya ia mudah dilihat.
3. Pekakas yang lebih besar dan tinggi lebih mudah dilihat.
4. Panjangkan lagi zon amaran di laluan yang ada lengkongan, berbukit atau halangan lain, serta di laluan di mana trafik adalah padat dan berkelajuan tinggi.
5. Sediakan ruang 'butter' sebagai perlindungan tambahan kepada trafik dan pekerja.
6. Peringatkan pengguna jalanraya supaya sentiasa berwaspada semasa melalui zon kerja yang panjang.
7. Pekakas keselamatan bagi membentuk lorong trafik seharusnya dari jenis yang boleh pecah atau terbalik sekiranya dilanggar.
8. Semua pekakas keselamatan seharusnya dari jenis yang boleh memantul cahaya.
9. Penanda yang mengelirukan di atas permukaan jalan perlu dipadamkan.
10. Sekiranya lampu amaran digunakan, lampu yang tidak berkelip seharusnya digunakan sebagai penanda lorong trafik sementara lampu yang berkelip digunakan sebagai tanda amaran.
11. Pekakas keselamatan perlu sentiasa diperiksa. Sekiranya rosak atau hilang, ia perlu dibaiki atau diganti. Semua pekakas perlu sentiasa bersih.
12. Rekod yang tepat perlu disimpan. Sekiranya berlaku kemalangan, catitkan sebarang pekakas keselamatan yang terlibat dan pekakas apa yang digunakan sebelum dan selepas kemalangan.
13. Jangan kelirukan pengguna jalanraya. Mana-mana papan tanda atau pekakas keselamatan yang tidak diperlukan seharusnya dikeluarkan atau ditutup.

Pelaksanaan Audit Pelan Pengurusan Trafik di Tapak Bina oleh Cawangan Senggara Fasiliti Jalan

Tujuan

Menjalankan audit ke atas pelaksanaan Pelan Pengurusan Trafik (TMP) berdasarkan pelan yang diluluskan oleh S.O.

Perancangan

- Menjalankan audit ke atas empat (4) projek jalan setiap bulan.
- Menjalankan audit susulan ke atas dua (2) projek jalan setiap bulan.
- Mengadakan mesyuarat penyelarasan bersama semua cawangan-cawangan yang terlibat pada minggu pertama setiap bulan, di bawah penyeliaan Cawangan Senggara Fasiliti Jalan (CSFJ).

Kaedah Pelaksanaan

- Memeriksa tapak pembinaan dengan merujuk pada TMP yang diluluskan.
- Menemubual S.O./ HOPT, Perunding dan Kontraktor.

Penglibatan

CSFJ, Cawangan Sistem Pengurusan Bersepadu, Cawangan Jalan dan Cawangan Kej. Jalan & Geoteknik.

Laporan Audit

Disediakan selewat-lewatnya pada minggu pertama setiap bulan.

- Laporan audit disediakan oleh pasukan audit yang terlibat dan dihantar oleh Unit Polisi CSFJ kepada S.O./HOPT.
- Ringkasan eksekutif disediakan oleh Unit Polisi CSFJ dan dihantar kepada Majlis Pengurusan Tertinggi, KSU dan Pengarah-Pengarah JKR Negeri.

Tindakan Susulan

- Menjalankan audit susulan ke atas projek yang sama secara terpilih bagi memastikan tindakan penambahbaikan telah diambil oleh S.O./HOPT berdasarkan pada cadangan yang dikemukakan oleh pasukan audit.
- Mengedar ringkasan eksekutif laporan audit kepada semua Pengarah JKR Negeri bagi mengambil iktibar dan memastikan ketidakpatuhan yang serupa tidak berulang di projek-projek di bawah pengawasan mereka.

Ringkasan Eksekutif Laporan Audit Pelan Pengurusan Trafik (Januari 2008)

Tujuan Menjalankankan audit ke atas pelaksanaan Pelan Pengurusan Trafik (TMP) berdasarkan pelan yang diluluskan oleh S.O.

Projek Audit Pelan Pengurusan Trafik telah dijalankan ke atas 12 projek. Senarai projek adalah seperti di lampiran A.

Kaedah Audit
*Pengauditan Pelan Pengurusan Trafik telah dijalankan oleh 13 orang jurutera dari Unit Polisi dan Unit Pengurusan Penyelenggaraan Jalan, Cawangan Senggara Fasiliti Jalan.
*Kaedah-kaedah yang telah dijalankan ialah;
- Memeriksa tapak pembinaan dengan merujuk pada TMP yang diluluskan.
- Menemubual S.O./ HOPT, Perunding dan kontraktor.

Hasil Kajian *Tahap Pematuhan setiap projek (Seperti Lampiran A)

TAHAP PEMATUHAN	% PEMATUHAN
Maksimum	92.7
Minimum	34.5
Purata	64.0

*Pasukan audit mengisi borang soal-selidik yang mempunyai 8 komponen. Berikut adalah hasil analisa bagi setiap komponen yang mengikut kepada borang soal-selidik untuk 12 buah projek :

Cadangan
*HOPT melaksanakan 'Performance Audit' setiap minggu dan menghantar laporan kepada S.O dan Cawangan Senggara Fasiliti Jalan.
*Mendirikan papan tanda di tapak pembinaan yang mempamerkan maklumat Pengurus Projek seperti nombor telefon bagi memudahkan pengguna jalanraya untuk menyalurkan sebarang aduan dengan segera.
*Menghantar Pelan Pengurusan Projek kepada Jabatan Pengangkutan Jalan, Polis DiRaja Malaysia dan Jabatan Keselamatan Jalan Raya.
*Mendaftar setiap projek pembinaan jalan dengan Jabatan Keselamatan dan Kesihatan Pekerjaan (DOSH).

Tindakan
*Menghantar 'Laporan Audit Pelan Pengurusan Trafik' kepada HOPT/ S.O.
*Meminta maklumbalas mengenai tindakan susulan ke atas sebarang ketidakpatuhan daripada HOPT/S.O.
*Salinan laporan akan dihantar kepada semua Pengarah JKR Negeri sebagai ikhtibar supaya TMP di projek-projek di setiap negeri dapat dipertingkatkan. Pada masa yang sama Pengarah-Pengarah JKR Negeri diminta untuk menjalankan audit TMP ke atas projek yang berada di bawah tanggungjawab masing-masing. Sekiranya tidak, CSFJ akan menjalankan audit tersebut.

Pengurusan Trafik

BIL	ITEM	BIL. PROJEK	
		PATUH	TIDAK PATUH
A	**SISTEM PENGURUSAN TRAFIK**		
	i) 'Traffic Safety Officer' dilantik.	11	1
	ii) Lukisan Pelan Pengurusan Trafik disediakan dan diluluskan oleh S.O.	7	5
	iii) Pelan Pengurusan trafik mengandungi tempoh pelaksanaan mengikut kerja semasa.	6	6
	iv) 'Traffic Management Safety Report' disediakan setiap 3 bulan.	10	2
	v) Audit Keselamatan jalan dilaksanakan.	7	5
B	**PAPAN TANDA**		
	i) 'Prismatic Grade'	7	5
	ii) Mencukupi.	1	11
	iii) Diselenggara.	7	5
	iv) Tidak mengelirukan.	6	6
C	**BARRIER**		
	i) 'Concrete barrier' di kawasan kerja yang mempunyai 'heavy machineries'.	4	6
	ii) 'Concrete barrier' di kawasan kerja dan laluan kenderaan dengan perbezaan aras lebih 1m.	5	4
	iii) 'Plastic barrier' secara 'interlock' di kawasan kerja dan laluan kenderaan dengan perbezaan aras kurang 1m.	4	7
	iv) 'Plastic barrier' berjarak di kawasan tiada aktiviti kerja.	11	1
	v) Teratur/kemas.	5	7
	iv) Diisi air/pasir.	6	6
D	**KERATAN RENTAS JALAN**		
	i) Lebar mencukupi (min. 3.00m).	11	0
	ii) Jumlah lorong sediaada dikekalkan.	11	0
E	**DELINEATION**		
	i) 'Blinker' mencukupi	8	4
	ii) 'String Delineator' mencukupi.	6	6
F	**JALAN SEMENTARA**		
	i) Diturap dan berkeadaan baik.	3	1
	ii) Tanda jalan dipasang	3	6
G	**LAIN-LAIN**		
	i) Jalan sediaada diselenggara dengan baik.	6	5
	ii) 'Flagmen' disediakan.	10	0
	iii) Keadaan tapak bersih/kemas	8	3
	vi) 'Advance warning area' mencukupi.	4	8
	v) 'Transition' & 'buffer area' disediakan.	5	4
	iv) 'Termination area' disediakan.	5	4
	iiv) Lampu jalan.	4	1
H	**KESELAMATAN PARA PEKERJA**		
	i) Baju/jaket keselamatan dipakai.	8	3
	ii) Topi keselamatan dipakai.	6	5
	iii) Kasut keselamatan dipakai.	10	1

Ringkasan Eksekutif Laporan Audit Pelan Pengurusan Trafik (Februari 2008)

Tujuan Menjalankankan audit ke atas pelaksanaan Pelan Pengurusan Trafik (TMP) berdasarkan pelan yang diluluskan oleh S.O.

Projek Audit Pelan Pengurusan Trafik telah dijalankan ke atas 12 projek. Senarai projek adalah seperti di lampiran A.

Kaedah Audit

*Pengauditan Pelan Pengurusan Trafik telah dijalankan oleh 11orang jurutera dari Unit Polisi dan Unit Pengurusan Penyelenggaraan Jalan, Cawangan Senggara Fasiliti Jalan.

*Kaedah-kaedah yang telah dijalankan ialah;

- Memeriksa tapak pembinaan dengan merujuk pada TMP yang diluluskan.
- Menemubual S.O./ HOPT, Perunding dan kontraktor.

Hasil Kajian

*Tahap Pematuhan setiap projek (Seperti Lampiran B)

TAHAP PEMATUHAN	% PEMATUHAN
Maksimum	97.5
Minimum	43.9
Purata	**75.15**

*Pasukan audit mengisi borang soal-selidik yang mempunyai 8 komponen. Berikut adalah hasil analisa bagi setiap komponen yang mengikut kepada borang soal-selidik untuk 12 buah projek :

Cadangan

*'Performance Audit' dijalankan oleh HOPT pada setiap minggu dan laporan dihantar kepada S.O dan Cawangan Senggara Fasiliti Jalan.
*Meletakkan papan tanda di tapak pembinaan yang mempamerkan maklumat Pengurus Projek seperti nombor telefon bagi memudahkan pengguna jalanraya untuk membuat aduan dengan segera.
*Menghantar Pelan Pengurusan Projek kepada Jabatan Pengangkutan Jalan, Polis DiRaja Malaysia dan Jabatan Keselamatan Jalan Raya.
*Mendaftar setiap projek pembinaan jalan dengan Jabatan Keselamatan dan Kesihatan Pekerjaan (DOSH).

Tindakan

*Menghantar 'Laporan Audit Pelan Pengurusan Trafik' kepada HOPT/ S.O.
*Meminta maklumbalas mengenai tindakan susulan ke atas sebarang ketidakpatuhan daripada HOPT/S.O.
*Salinanlaporanakan dihantar kepada semua Pengarah JKR Negeri sebagai ikhtibar supaya TMP di projek-projek di setiap negeri dapat dipertingkatkan. Pada masa yang sama Pengarah-Pengarah JKR Negeri diminta untuk menjalankan audit TMP ke atas projek yang berada di bawah tanggungjawab masing-masing. Sekiranya tidak, CSFJ akan menjalankan audit tersebut.

BIL	ITEM	BIL. PROJEK PATUH	BIL. PROJEK TIDAK PATUH
A	**SISTEM PENGURUSAN TRAFIK**		
	i) 'Traffic Safety Officer' dilantik.	3	3
	ii) Lukisan Pelan Pengurusan Trafik disediakan dan diluluskan oleh S.O.	4	3
	iii) Pelan Pengurusan trafik mengandungi tempoh pelaksanaan mengikut kerja semasa.	2	5
	iv) 'Traffic Management Safety Report' disediakan setiap 3 bulan	3	2
	v) Audit Keselamatan jalan dilaksanakan.	3	2
B	**PAPAN TANDA**		
	i) 'Prismatic Grade'	6	1
	ii) Mencukupi.	4	3
	iii) Diselenggara.	5	2
	iv) Tidak mengelirukan.	5	1
C	**BARRIER**		
	i) 'Concrete barrier' di kawasan kerja yang mempunyai 'heavy machineries'	2	2
	ii) 'Concrete barrier' di kawasan kerja dan laluan kenderaan dengan perbezaan aras lebih 1m.	2	2
	iii) 'Plastic barrier' secara 'interlock' di kawasan kerja dan laluan kenderaan dengan perbezaan aras kurang 1m	4	2
	iv) 'Plastic barrier' berjarak di kawasan tiada aktiviti kerja.	6	0
	v) Teratur/kemas.	6	7
	iv) Diisi air/pasir.	4	3
D	**KERATAN RENTAS JALAN**		
	i) Lebar mencukupi (min. 3.00m).	6	0
	ii) Jumlah lorong sediaada dikekalkan.	5	1
E	**DELINEATION**		
	i) 'Blinker' mencukupi.	5	2
	ii) 'String Delineator' mencukupi.	5	2
F	**JALAN SEMENTARA**		
	i) Diturap dan berkeadaan baik.	5	0
	ii) Tanda jalan dipasang	4	1
G	**LAIN-LAIN**		
	i) Jalan sediaada diselenggara dengan baik.	5	2
	ii) 'Flagmen' disediakan.	6	1
	iii) Keadaan tapak bersih/kemas	6	1
	vi) 'Advance warning area' mencukupi.	5	2
	v) 'Transition' & 'buffer area' disediakan.	3	3
	iv) 'Termination area' disediakan.	2	4
	iiv) Lampu jalan.	4	0
H	**KESELAMATAN PARA PEKERJA**		
	i) Baju/jaket keselamatan dipakai.	4	3
	ii) Topi keselamatan dipakai.	3	4
	iii) Kasut keselamatan dipakai.	6	1

Lampiran A

TAHAP PEMATUHAN PELAN PENGURUSAN TRAFIK (Januari 2008)

BIL	PROJEK	NO KONTRAK	TARIKH AUDIT	% KEPATUHAN	RUJUKAN LAPORAN
1	Projek Menaiktaraf Laluan FT175 dari Pekan Gurun Ke Pekan Sik, Kedah.	KKR/JKR/IP/UB/87/2003	13 JANUARI 2008	52.38%	JKR/CSFJ/UKPJ/TMP(1)
2	Projek Naiktaraf Laluan 3, km11-km18, Jalan Kuala Terengganu – Kuantan, Marang, Terengganu.	JKR/IP/CKUB/118/2006	21 JANUARI 2008	86.5%	JKR/CSFJ/UKPJ/TMP(2)
3	Projek Memperelokkan Jalan Dari Bulatan Sultan Mansor ke Kuala Berang, Terengganu, Pakej 3 Dari Bukit Payong ke Binjai Rendah (km14-km20).	JKR/IP/CKUB/72/2005	21 JANUARI 2008	53.75%	JKR/CSFJ/UKPJ/TMP(3)
4	Projek Menaiktaraf Jalan T1/T3 Dari Merang Ke Kuala Besut, Terengganu.	JKR/IP/CKUB/41/2005	21 JANUARI 2008	84.4%	JKR/CSFJ/UKPJ/TMP(4)
5	Projek Naiktaraf Laluan Persekutuan 3, km69 –km72, Jalan Kuala Terengganu – Kota Bharu Di Pekan Permaisuri, Terengganu.	JKR/IP/CKUB/30/2006	21 JANUARI 2008	92.7%	JKR/CSFJ/UKPJ/TMP(5)
6	Projek Naiktaraf Laluan Persekutuan 3, km-km, Jalan Kuala Terengganu - Kota Bharu, Terengganu.	JKR/IP/CKUB/28/2006	22 JANUARI 2008	73.8%	JKR/CSFJ/UKPJ/TMP(6)
7	Projek Menaiktaraf Laluan 3, km 97.4 -km 108, Jalan Kuala Terengganu – Kuantan, Terengganu.	JKR/IP/CKUB/02/2006	22 JANUARI 2008	70.83%	JKR/CSFJ/UKPJ/TMP(7)
8	Projek Menaiktaraf/ Menaik Aras Jalan Chukai ke Air Putih. km11-km14, Sungai Pinang, Kemaman, Terengganu.	-	23 JANUARI 2008	27.1%	JKR/CSFJ/UKPJ/TMP(8)
9	Ayer Hitam – Kluang, Johor (Fasa 2: Membina Pusingan U, median dan kerja berkaitan)	JKR/IP/CKUB/101/2006	31 JANUARI 2008	73.0%	JKR/CSFJ/UKPJ/TMP(9)
10	Projek Menaiktaraf Jalan Jitra melalui Kodiang, Kedah ke Arau, Perlis, Pakej 2 : CH4500 – CH17500	JKR/IP/CKUB/100/2005	30 JANUARI 2008	62.7%	JKR/CSFJ/UKPJ/TMP(10)
11	Projek Menaiktaraf Jalan Jitra melalui Kodiang, Kedah ke Arau, Perlis, Pakej 3 : CH17500 – CH21500	JKR/IP/CKUB/159/2005	30 JANUARI 2008	34.5%	JKR/CSFJ/UKPJ/TMP(10)
12	Projek Menaiktaraf Jalan Jitra melalui Kodiang, Kedah ke Arau, Perlis, Pakej 4 : CH21500 – CH26881.173	JKR/IP/CKUB/160/2005	30 JANUARI 2008	56.0%	JKR/CSFJ/UKPJ/TMP(10)
		PURATA TAHAP PEMATUHAN (%)		64.0%	

Lampiran B

TAHAP PEMATUHAN PELAN PENGURUSAN TRAFIK (Februari 2008)

BIL	PROJEK	NO. KONTRAK	TARIKH AUDIT	% KEPATUHAN	RUJUKAN LAPORAN
1	Naiktaraf Laluan Persekutuan 5 dari Ipoh – Lumut, Perak.	KKR/JKR/IP/UB/24/2004	1 FEBRUARI 2008	76.93%	JKR/CSFJ/UKPJ/TMP(10)
2	Projek Menaiktaraf Jalan Gopeng – Siputeh, Pakej 2 : Membina Jalan Baru Batu Gajah By-Pass dan Menaiktaraf Jalan A108, Kinta.	JKR/IP/CJ/10/2006	1 FEBRUARI 2008	43.9%	JKR/CSFJ/UKPJ/TMP(10)
3	Projek Menaiktaraf Jalan Johor Bahru – Pasir Gudang (FT017), Johor. (Menaiktaraf Persimpangan Bertingkat Perling)	JKR/IP/CKUB/8/2006	1 FEBRUARI 2008	97.5%	JKR/CSFJ/UKPJ/TMP(11)
4	Projek Naiktaraf Jalan Rantau Ke Linggi (N7), Daerah Port Dickson, Negeri Sembilan – Fasa 1.	JKR/NS/P/PD/013/2007	1 FEBRUARI 2008	73.0%	JKR/CSFJ/UKPJ/TMP(12)
5	Projek Naiktaraf Jalan Benta – Jerantut – Maran, Pahang Fasa 3 : dari Simpang Jengka Ke Maran (Pakej 2 : Segmen 4-6A).	JKR/IP/CKUB/120/2006	1 FEBRUARI 2008	82.0%	JKR/CSFJ/UKPJ/TMP(13)
6	Bukit Genting, Seksyen 262, Laluan FT02, Daerah Maran, Pahang.	-	1 FEBRUARI 2008	82.0%	JKR/CSFJ/UKPJ/TMP(14)
7	Menaiktaraf Jalan dan Jambatan Tg. Gahai, Daerah Lipis, Pahang.	F/PHG/L/DK/1105/2006	4 FEBRUARI 2008	71.0%	JKR/CSFJ/UKPJ/TMP(15)
	PURATA TAHAP PEMATUHAN (%)			75.15%	

Kekurangan papan tanda di kawasan lencongan dan tiada *'advance warning area'* sebelum kawasan lencongan dan pembinaan.

Tidak menggunakan *'plastic barrier'* secara *'interlock'* dan tidak teratur di kawasan kerja menyebabkan laluan kenderaan sempit dan merbahaya

Tidak menggunakan *'plastic barrier'* secara *'interlock'* dan teratur di kawasan kerja dan laluan kenderaan yang mempunyai perbezaan aras kurang dari 1m.

Tidak menggunakan *'plastic barrier'* secara *'interlock'* dikawasan kerja dan laluan kenderaan yang mempunyai perbezaan atas kurang dari 1m.

'String delineator' yang lusuh dan tidak diselenggara atau diganti menyebabkan *'string delineator'* ini tidak efektif pada waktu malam.

Tidak menggunakan *'concrete barrier'* secara *'interlock'* dan teratur di kawasan kerja dan laluan kenderaan yang mempunyai perbezaan aras melebihi 1m.

Laporan bergambar audit pelaksanaan Pelan Pengurusan Trafik di tapak bina

Nota: Nama dan lokasi projek tidak dinyatakan atas sebab-sebab tertentu - Pengarang

Anak panah di atas permukaan jalan yang mengelirukan pemandu kerana sebenarnya dihadapan tiada belok ke kanan.

Tidak menggunakan *'plastic barrier'* secara *'interlock'* di kawasan kerja dan laluan kenderaan yang mempunyai perbezaan aras melebihi 1m

Laluan dua hala dengan *'temporary road line'* yang mengelirukan dan tiada papan tanda yang menunjukkan laluan dua hala.

Tidak menggunakan *'concrete barrier'* secara *'interlock'* di kawasan kerja yang mempunyai *'heavy machinery'*.

Tidak meletakkan papan tanda di lokasi yang betul. Papan tanda mengelirukan pemandu kerana sebenarnya tiada lencongan di kawasan tersebut.

Papan tanda ditiru bulat-bulat dari Arahan Teknik. Kenapa tidak diisi maklumat dalam petak?

MARRIS *on-line*

oleh Fazleen Hanim Ahmad Kamar

MESYUARAT MARRIS ON-LINE ZON SELATAN DI JOHOR BAHRU PADA 24 HINGGA 26 MAC 2008

PADA 24 - 26hb Mac 2008, Cawangan Senggara Fasiliti Jalan telah menganjurkan "Mesyuarat Pengendalian Sistem MARRIS Secara On-Line" bertempat di Hotel Mutiara, Johor Bahru.

Mesyuarat ini adalah yang julung-julung kali diadakan dan JKR Negeri Johor merupakan tuan rumah pada kali ini. Perasmian telah disempurnakan oleh Ir. Shafii bin Mohamad mewakili Pengarah Cawangan Senggara Fasiliti Jalan. Seramai 154 orang peserta telah hadir mewakili pelbagai kementerian dan agensi kerajaan antaranya Kementerian Kewangan, Kewangan Negeri, JKR Negeri, Majlis Bandaraya, Majlis Perbandaran, Pihak Berkuasa Tempatan serta Kementerian Pertanian dan Kementerian Kemajuan Luar Bandar Dan Wilayah.

Tujuan mesyuarat ini diadakan ialah untuk memberi penerangan dan latihan secara *hands-on* kepada peserta-peserta bagi mendaftar dan mengemaskini data-data jalanraya secara *on-line* dengan menggunakan sistem MARRIS *on-line*. Latihan ini telah dikendalikan oleh Bahagian Teknologi Maklumat, Kementerian Kewangan.

Sistem Maklumat Rekod Jalanraya Malaysia (Malaysia Road Record Information System – MARRIS) ini digunakan bagi tujuan merekodkan data-data jalanraya di seluruh negeri merangkumi Jalan Negeri, Jalan Perbandaran, Jalan Kawasan Perumahan Murah, Lorong Belakang, Jalan Sehala Pulau Pelancongan, Jalan Kampung dan Jalan Pertanian.

Sebelum sistem MARRIS *on-line* ini dibangunkan, semua data-data jalan didaftarkan secara manual. Bahagian Teknologi Maklumat, Kementerian Kewangan telah mengambil inisiatif dengan membangunkan satu sistem *on-line* sebagai penambahbaikan kepada sistem yang sedia ada. Dengan pengenalan sistem baru ini, ia dapat mempercepatkan proses pendaftaran data-data jalan di mana pengguna dapat membuat semakan status secara *on-line*. Ini juga dapat meminimakan kesilapan pengguna-pengguna semasa mengisi borang-borang MARRIS.

Beberapa sesi mesyuarat sepertimana yang telah diadakan di Johor Bahru lepas telah dirancang bagi seluruh negara. Jadual penuh adalah seperti berikut;

TARIKH	ZON	TEMPAT
24 – 26 Mac 2008	**Selatan** (Johor, Melaka & Negeri Sembilan)	Johor Bahru
7 – 8 April 2008	**Tengah** (Selangor, WP Kuala Lumpur, WP Putrajaya, Perbadanan Putrajaya & DBKL)	Shah Alam
21 – 23 April 2008	**Timur** (Kelantan, Terengganu & Pahang)	Kota Bharu
19 – 21 Mei 2008	**Utara** (Kedah, Pulau Pinang, Perak, Perlis)	Perlis
2 – 4 Jun 2008	Sabah & WP Labuan	Kota Kinabalu
23 – 25 Jun 2008	Sarawak	Miri

Surface Regularity

Undulation on road surfacing

By Ir. Mohd Hizam Harun

Table 4.14 in JKR/SPJ/1988 allows surface irregularities to be measured using rolling straight-edge over a traverse length of 75 metres and 300 metres. It is therefore imperative to request the contractor to carry out the measurement over the specified lengths as soon as the construction of any part of the carriageway is completed before allowing further paving works to proceed. This will enable any discrepancies, in case the maximum permissible number of surface irregularities is exceeded, to be identified and rectified at an early stage.

However, where the measurements were actually done albeit very limited cases, it was carried out when the carriageway was almost or fully completed but in most cases, the contractor did not bother to carry out the measurements at all and was let off the hook by the ignorant supervisory personnel.

If any section of the carriageway which did not comply with the tolerances for surface irregularities as stipulated in JKR/SPJ had not been accepted, and the contractor had been duly instructed to identify the causes of and rectify the defects until it was satisfactory to the S.O., then undulating surfaces would no longer be a common sight.

Readings should be recorded whenever the dial gauge on the rolling straight-edge registers rise or fall equals to or greater than 4 mm but less than 7 mm, and equals to or greater than 7 mm but less than or equals to 10 mm, and greater than 10 mm as the straight-edge device is being pushed along the road.

Sub-Section 4.5.3.2 in JKR/SPJ/2008-S4 states that the regularity of the completed pavement surface shall be measured before traffic is allowed on it and is measured in terms of its lane International Roughness Index (IRI). The Contractor shall make available lane IRI values for the whole road length as well as for each 100 metre section of the completed pavement surface. The lane IRI measured for the whole road length and each 100 metre section shall be less than 2.0 m/km. In case of non-compliance, the Contractor shall carry out rectification works on any part of the completed pavement surface so that the lane IRI values for the whole road length and for each 100 metre section are less than 2.0 m/km.

Class of Surface Regularity	Longitudinal Direction				Transverse Direction
	Maximum Permissible Number of Surface Irregularities				Maximum Permissible Depth Of Transverse Irregularities
	Depth Exceeding 4 mm		Depth Exceeding 7 mm		
	over traverse length of 300 m	over traverse length of 75 m	over traverse length of 300 m	over traverse length of 75 m	
Class SR1	20	9	2	1	4 mm
Class SR2	40	18	4	2	8 mm
Class SR3	60	27	6	3	12 mm
No longitudinal irregularity exceeding 10 mm shall be permitted for Class SR1 Surface Regularity and no longitudinal irregularity exceeding 15 mm shall be permitted for Class SR2 and Class SR3 Surface Regularities.					
The class of Surface Regularity for each portion of the Works shall be as stated on the Drawings or in the Bills of Quantities					

Table 4.14 in JKR/SPJ/1988: Tolerances for surface irregularities.

Rolling straight-edge

Bad road surfacing

Good road surfacing

Sistem Pengurusan Bencana Jabatan Kerja Raya

Jabatan Kerja Raya Malaysia

JKR

Pendahuluan

Sebagai agensi teknikal utama di Malaysia, JABATAN KERJA RAYA (JKR) memainkan peranan yang amat besar dalam setiap kejadian bencana yang berlaku. Pengalaman yang telah dilalui dalam hampir setiap kejadian bencana di Malaysia seperti banjir, tsunami, tanah runtuh, runtuhan bangunan, kegagalan struktur dan sebagainya telah memperkasakan JKR agar sentiasa bersiap sedia dengan sistem pengurusan bencana yang bersepadu dan terkini bagi menghadapi bencana pada masa akan datang.

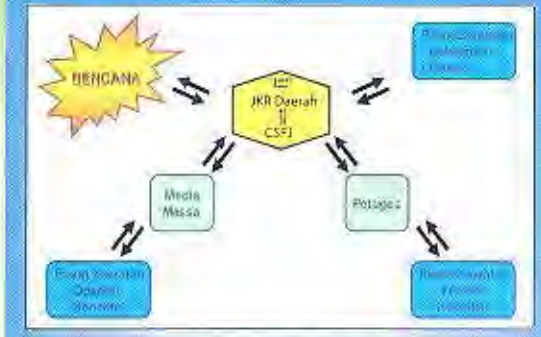
Antara kemungkinan bencana yang boleh berlaku dan memerlukan penglibatan JKR adalah seperti banjir, ribut, kemarau, hakisan pantai, tanah runtuh, bencana industri, kemalangan, keruntuhan bangunan / struktur, kebakaran bangunan / struktur kompleks, kemalangan nuklear / radiologi, kejadian pelepasan gas beracun dan kejadian pengeboman.

Dalam sesuatu operasi pengurusan dan bantuan ketika berlaku bencana, JKR berperanan sebagai agensi bantuan dan pemulihan seperti :

- ✓ Memberi sokongan dari segi keperluan loji-loji, kenderaan, kakitangan untuk kerja-kerja mengemas tempat bencana dan pengangkutan.
- ✓ Menyediakan tempat berlindung sementara seperti kanopi atau khemah.
- ✓ Membekalkan air dan menaikkan tekanan air di kawasan yang memerlukannya (tindakan pihak berkuasa bekalan air).
- ✓ Menyediakan perkhidmatan teknikal dan pakar dalam bidang kejuruteraan forensik (pakar), geoteknik, struktur dan lain-lain seperti dalam kes tanah runtuh dan kegagalan struktur.
- ✓ Menyediakan kerja-kerja baikpulih seperti cerun runtuh dan sebagainya.
- ✓ Menyediakan Senarai Data Kelengkapan dan Senarai Kakitangan dalam masa bencana.

Pelan Tindakan Operasi Bencana

Aliran Perhubungan Ketika Kejadian Bencana



Tindakan Kecemasan Oleh JKR

- ✓ Tanah runtuh dan banjir
- ✓ Kegagalan tambakan dan jalan tenggelam
- ✓ Kerosakan / Runtuhan jambatan
- ✓ Kerosakan pembetung dan struktur saliran
- ✓ Tumpahan bahan kimia berbahaya
- ✓ Halangan jalan raya dan pokok tumbang

Prosedur Tindakan Kecemasan JKR

Pembangunan Sistem Sokongan

Sistem Pemantauan Banjir Berkamera (E-Banjir)

E-Banjir merupakan satu sistem pemantauan banjir berkamera yang dipasang di beberapa lokasi. Melalui sistem ini keadaan banjir dapat dipantau sepanjang masa melalui laman web.

Sistem Pengurusan Cerun dan Pengesanan Risiko

JKR telah membangunkan sistem Slope Management and Risk Tracking (SMART) yang merupakan program pengurusan cerun untuk mengenalpasti risiko dan kestabilan cerun di sepanjang jalan bagi tujuan penyenggaraan berterusan dan mengatasi berlakunya bencana di luar jangkaan.

Talian Aduan JKR

Bagi meningkatkan sistem penyampaian maklumat kejadian bencana, JKR memperkenalkan tiga kaedah aduan terpantas iaitu melalui sistem khidmat pesanan ringkas (SMS), e-mel dan talian hotline.

Laman Web Bencana Alam JKR

Perkembangan kejadian bencana terkini dapat diketahui oleh pengguna melalui laman web Bencana Alam JKR di alamat www.jkr.gov.my/bencanaalam.

Stok Jambatan Panel Keluli Bermodular

Jambatan panel keluli bermodular merupakan aset penting JKR sebagai persediaan menghadapi bencana. JKR mempunyai tiga set jambatan mudah alih yang dikendalikan oleh empat pasukan terlatih mengikut zon.

Sistem Pengurusan Jambatan JKR (JKR-BMS)

JKR Bridge Management System (JKR BMS) merupakan sistem yang membantu pemilihan keutamaan program menaiktaraf, baikpulih atau penyenggaraan jambatan, jejambat dan jejantas.

Pemulihan

Melaksanakan kawalan trafik di lokasi bencana


Menyediakan laluan alternatif


Melaksanakan pemulihan menyeluruh

Talian Aduan & Kecemasan

- ✓ *SMS*
  Taip JKR <aduan> hantar ke 32728
- ✓ *Hotline*
  1-800-88-5004
- ✓ *E-mel Aduan Kerosakan Jalan*
  aduan@jkr.gov.my
- ✓ *E-mel Bencana*
  bencana@jkr.gov.my
- ✓ *Bilik Gerakan Bencana JKR*
  Tel : 03-2696 7727
  Faks : 03-2694 7550
- ✓ *Laman Web Bencana JKR*
  www.jkr.gov.my/bencanaalam
- ✓ *Cawangan Senggara Fasiliti Jalan*
  Tel : 03-2696 7725
  Faks : 03-2694 7550
- ✓ *Syarikat Konsesi*

Belati Wangsa (M) S/B (Zon Utara)
Tel : 05-2552211 Faks : 05-2418111

Roadcare (M) S/B (Zon Tengah / Timur)
Tel : 03-92852257 Faks : 03-92854270

Selia Selenggara Selatan S/B (Zon Selatan)
Tel : 06-2318140 Faks : 06-2318246

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Mix bitumen with crumb rubber, what do we get?

Harun @ Kuzlawati Razali

Abstract

As bitumen additive, various forms of rubber which include scrap rubber from motor vehicle tyres (crumb rubber) have been used for many years throughout the world with varying degree of success. This fact has interest to both rubber producers and road engineers in Malaysia, particularly in producing road surfacing bituminous materials with improved durability and stability. In addition, the use of crumb rubber sounds very attractive from the point of view of preservation of the environment. The disposal of used tyres poses quite a serious problem in Malaysia and throughout the world as they are virtually indestructible except by burning which again creates another problem in the form of air pollution.

With this in mind, a Memorandum of Agreement between Lembaga Getah Malaysia (LGM) and Jabatan Kerja Raya Malaysia (JKR) was signed in December 2002 whereby both parties jointly agreed to carry out a joint development project titled "The Use of Crumb Rubber as Bitumen Additive". It was specifically prepared to carry out a full-scale road trial project using crumb rubber as bitumen additive on Route 2 in Kuantan.

A full-scale road trial was successfully constructed on Route 2, Section Nos. 340 - 345, Kuantan bound, in June 2003.

The objectives of the trial were to compare the performance of dense graded bituminous overlay incorporating crumb rubber modified bitumen in mitigating reflective cracking with a similar overlay using conventional penetration grade 80-100 bitumen and to assess the durability of porous asphalt incorporating crumb rubber modified bitumen as well as a proprietary modified bitumen produced by Petronas.

Based on the performance of the test sections 52 months after construction, there was an indication that the presence of crumb rubber in asphalt mixtures could significantly mitigate the propagation of cracks from underlying layers through relatively thin overlay with relatively fine aggregate gradation. This was shown by considerably less percentage of cracks that was reflected. However, with coarser aggregate gradation and thicker overlay, the crumb rubber does not appear to impart appreciable improvements in resistance to reflective cracking as it was observed that the section with crumb rubber performed only slightly better than the section without crumb rubber after 52 months.

There was no ravelling in all three porous asphalt test sections after the same period. This could be attributed to the relatively thick film of binder coating the aggregates and improved resistance to oxidative aging of the binder due to the presence of either crumb rubber or proprietary additive.

Introduction

THE USE of scrap rubber from motor vehicle tyres as bitumen additive in the road construction industry sounds very attractive from the point of view of preservation of the environment. The disposal of the used tyres poses quite a serious problem in Malaysia and throughout the world as they are virtually indestructible except by burning which again creates another problem in the form of air pollution.

As bitumen additive, various forms of rubber which include scrap rubber from motor vehicle tyres (hereafter is referred to as crumb rubber) have been used for many years throughout the world with varying degree of success. This fact has interest to both rubber producers and road engineers in Malaysia, particularly in producing road surfacing bituminous materials with improved durability and stability.

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As stated in the above Memorandum of Agreement, LGM *inter alia* has the expertise in the development of different forms of rubber for use as bitumen additives in road construction whereas JKR *inter alia* has the expertise in the production and placement of asphalt mixes incorporating various forms of bitumen additive including crumb rubber.

Literature Review

The concept of adding rubber into bitumen is more than 100 years old. The first attempt was made in 1898 by de Cauderberg who patented a process for manufacturing rubber – bitumen. However, many difficulties were encountered in exploiting the patent and the process lapsed before 1914.

While the rubber industry had been using bitumen to modify rubber for various purposes, no further progress was made in the modification of bitumen by adding rubber until rubber in granular or powder form was developed in 1930. Then, laboratory assessment and some full-scale road trials on rubber-modified bitumen commenced, notably in the Netherlands and Great Britain. It was reported that the trial sections laid in 1936 at Bussum, the Netherlands showed marked improvement, and the rubberised rolled-asphalt surfacing at New Cross, Great Britain was still in good condition in 1959 after 22 years[1].

The concept of using recycled rubber from car and truck tires, typically referred to as crumb rubber, is at least 50 years old. Laboratory and field trials were carried out from the mid 1950s onwards. Experiments showed promising results when crumb rubber - modified binder was used for seal coats and stress-absorbing membranes, but yielded initially mixed results in terms of performance and cost effectiveness when crumb rubber was used as modifier for asphalt paving mixtures.

Experiences in the United Kingdom

During the period 1953 - 1966, the Road Research Laboratory of the United Kingdom in co-operation with the Natural Rubber Producers' Research Association (NRPRA, Malayan Rubber Fund Board) carried out a research programme to investigate the possibility of improving the performance of road surfacing by incorporating a small proportion of rubber in bituminous binders[1].

In those early days, the forms of rubber which were available for incorporation into the binder were;

i. Latex. Extract from rubber trees which was concentrated and stabilised in various ways. Available in two forms, evaporated and centrifuged.
ii. Sheet rubber. Made from coagulated latex.
iii. Rubber powder. Made either by spray-drying the latex or by hammer-milling lightly vulcanised coagulum to form a crumb. Available in several forms;
   - Pulvatex - an unvulcanised rubber powder containing 40% inert filler.
   - Mealorub - a lightly vulcanised powder containing 96% rubber.
   - Harcrumb - substantially similar to Mealorub. Manufactured in then Malaya.
   - Rodorub - a lightly vulcanised powder containing 75% natural rubber and 25% inert filler.
iv. Ground tyre-tread. Waste tyres ground into a powder.

In Huntingdonshire, it was reported that bitumen macadam, rubberised by direct addition of about 7% Pulvatex to the asphalt mixes and laid down in 1955, had lasted eight years as compared to a normal life of six years with standard bitumen macadam[2].

In a full-scale experiment on trunk road A6 in Leicestershire in 1963, Szatkowski[3] reported that asphalt mixes containing 4% natural rubber in the form of evaporated latex and with the binder content increased by 1% had exhibited more resistant to reflection cracking than standard mixes.

It was highlighted elsewhere[4] that latex was the most effective form of rubber, followed by unvulcanised rubber powders (eg. Pulvatex). Vulcanised rubber powders (eg. Harcrumb) dispersed more slowly and were less effective due to the breakdown of rubber during dispersion. As such, addition by dry process was not recommended.

In their Technical Bulletin No.9[5], NRPRA highlighted that four forms of natural rubber which were commonly used in the preparation of bituminous binders were centrifuged latex, evaporated latex, lightly vulcanised or unvulcanised rubber powders specially prepared for blending into bitumen (eg. Harcrumb, Rodorub and Pulvatex) and sheet rubber. Rubber powder from scrap sources was then not recommended as it was variable in composition and generally too highly vulcanised to blend into bitumen without prolonged and excessive heating.

Experiences in Malaysia

In Malaysia, trials using rubberised bitumen were initiated in 1950s when 100 yards of road between Kota Bharu and Kuala Krai was laid with 5% rubber powder. Following that, several other trials were laid in the states of Kedah, Perlis, Kelantan, Johor, Negeri Sembilan and Melaka. Unfortunately, none of these trials was monitored closely and as such no details are available.

Chew and Ting[6] reported a full-scale experiment that was carried out in late 1968 at two sites; KL – Seremban road at mile 17 - 18 and KL - Bentong road at mile 14 ¼ - 14 ½. A conventional 80 - 100 penetration grade bitumen was used with 1.5% and 3% natural rubber latex. The trial sections however failed after three years due to rapid increase in traffics. At that point, JKR concluded that there was nothing to be gained by adding rubber into road surfacing.

With the formation of Institut Kerja Raya Malaysia in 1987, a more concerted effort was given by JKR in the research work. Collaboration with Rubber Research Institute of Malaysia (RRIM) was solicited to tap expertise from local rubber researchers. A number of laboratory assessments and field trials were subsequently conducted under the collaborative study as described below.

Laboratory Assessment

RRIM researcher Azemi[7] carried out laboratory assessment on the toughness, elongation at break, tenacity and yield strength of rubberised bitumen samples using an Instron 4206 machine. The samples were prepared using four different forms of rubber namely prevulcanised NR latex, NR latex concentrated, rejected glove crumbs and tyre shavings.

A similar study was carried out earlier by Institut Kerja Raya Malaysia whereby the temperature susceptibility of rubberised bitumen prepared using various forms of rubber was evaluated[8].

In the RRIM's laboratory, Lai and Rouyan[9] investigated on the use of Pyrolysis Gas Chromatography to determine the content of unvulcanised rubber in rubberised bitumen blend.

Field Trials

a. Klang Trial

The first opportunity to construct a full-scale road trial under

the collaborative study came in 1988 during the construction of a new dual carriageway in Port Klang. Natural rubber latex at 2% concentration had been proposed for the trial. The plant engaged to manufacture the bituminous materials was a continuous drum mixer. It had no facility for injecting latex directly into the mixing drum, therefore the rubber was preblended with bitumen in the bitumen storage tank prior to mixing. TRRL Road Note 36[12] specified that a propeller type stirrer should be used. However, the plant did not have this facility so the contractor proposed to blend the latex into the bitumen by circulating the binder from one storage tank to another by means of an external circulating pump. This method of blending was not satisfactory as the resulted blend of rubber and latex was not uniform. Nonetheless, some latex which appeared to have blended with the bitumen seemed to have improved the performance of the modified binder in that the aging of the top few millimetres of the surfacing appeared to be less than in the control and the stiffening effect of the rubber additive reduced FWD deflections more than in the control[10,11].

b. Rembau Trial

In December 1993, another trial was constructed on Route 1, between Rembau and Tampin. The trial spanned about one kilometre with eight different test sections. Three forms of rubber were used: latex, tyre shaving (or crumb rubber) and rubber powder from rejected domestic gloves. Dry process of mixing was adopted whereby a measured amount of the rubber additives was manually added into the pugmill. Dense graded asphaltic concrete and bituminous macadam, and open graded porous asphalt were laid in the test sections.

Up to May 1997, when the last monitoring was carried out, the control test section showed an average rut depth of 2.3 mm while the rest of the test sections had either zero or negligible rut. All test sections had not cracked then.

Indirect Tensile Strength (IDT) tests carried out on cored samples indicated consistently that rubberised mixes had stiffness modulus higher than the conventional mix.

c. Sg. Buluh Trial

This trial was constructed in December 1996 whereby three kilometres of rubberised mix and one kilometre of conventional mix were constructed. Rubberised bitumen was produced by blending crumb rubber from old tyres passing No. 40 mesh with 80/100 penetration grade bitumen. Detail evaluations were carried out within a 200-metre stretch in each test section.

The only post construction survey reported was carried out in January - March 1997. Except for some localised minor segregation problems found in the control test section, there was no other distress observed then.

Laboratory test results from the trial, however, showed some inconsistent properties. For example, the binder content of the control mix was much lower (4.1%) than the rubberised mix (5.8%) whereas the air voids content was lower in the control mix. There are two possible explanations for this inconsistency: the centrifugal method of binder recovery in accordance to ASTM D 2172 was not accurate enough when rubberised bitumen was involved and the presence of rubber granules in the mix had resisted compaction thereby resulting in relatively high air voids even at relatively high binder contents.

Laboratory dynamic creep tests indicated that the rubberised mix reaches 3% strain faster than the control mix. Based on this observation, it would imply that the rubberised mix had less resistance to permanent deformation. However, the presence of relatively high air voids in the rubberised mix that might contribute to earlier strain development merits a review on this implication.

Both the rubberised and control mixes have relatively low density. The mean density for the control and the rubberised mix was reported to be 2.193 Mg/m^3 and 2.154 Mg/m^3 respectively compared to typical values in the range 2.30 - 2.35 Mg/m^3 for dense graded mix. This could be attributed to inadequate compaction during construction.

d. KLIA Project

The experience mentioned above had led Institute Kerja Raya Malaysia to propose the use of rubberised bitumen in the prestigious KL International Airport project.

Specification Series 900 of the KL International Airport project included the preparation of rubberised bitumen in compliance with TRRL Road Note 36[12] for use in the construction of wearing course of the perimeter road. As recommended by RRIM, high quality grade natural rubber powder with specific vulcanizate properties was specified (refer to page 25 for further details). It did not, however, specifically indicate that crumb rubber from old tyres should be used as the rubber additive.

Superpave performance grade PG70 in compliance with AASHTO MP1 – Standard Specification For Performance Graded Asphalt Binder[13,14] was specified for the rubberised bitumen.

A total length of approximately 50 kilometres of the wearing course of the perimeter road was successfully constructed using rubberised bitumen blend of crumb rubber from old tyres which was tested and certified by LGM. The modified bitumen product, called *Shell Rubberised Bitumen*, met performance grade PG70 specification and had been used extensively in the KLIA perimeter road.

e. Other Proprietary Product

Bitumimus Premium-R is a proprietary formulation of rubberised bitumen produced and marketed by Petronas. It was claimed that the binder had been used to manufacture dense asphalt mixes for over 15 kilometres of road in Putrajaya as well as access roads and parking areas at the oil and gas plants in Kerteh and Gebeng.

Experiences in India

India is currently the leading user of crumb rubber for modification of asphalt in Asia. "Guideline Specifications on the Use of Polymer and Rubber Modified Bitumen in Road Construction" were issued by the Indian Roads Congress (IRC) as Special Publication 53 in 1999, and a First Revision of these guidelines was published in 2002. The Bureau of Indian Standards has issued in 2004 Indian Standard IS 14462, which is similar but not identical to IRC Special Publication 53. Both IRC guidelines and IS Standard 14462 include separate specification properties for bitumen modified with natural rubber (NRMB) and for bitumen modified with crumb rubber (CRMB).

Of the three CRMB grades included in IS 14462, CRMB 60 is most appropriate for use on major highways located in hot climate. Comparative testing was carried out on polymer and crumb rubber modified binders from India, using traditional (Indian) test methods and specifications as well as more advanced test methods and specifications for Performance Graded Binders (AASHTO M 320 and ASTM D 6373). It was found that CRMB 60 is about equivalent to PG 76, which is a widely specified binder grade for heavily trafficked highways in warm to hot climates.

Experiences in Europe

In Europe, crumb rubber has so far not been as extensively used as asphalt modifier as in the US. However, the European Tire Recycling Association (ETRA) is aggressively promoting environmental and performance benefits of crumb rubber as bitumen additive, and in view of the increasing emphasis on the need for recycling and economic use of recycled materials, crumb rubber usage in asphalt pavement is expected to increase also in Europe.

Experiences in the United States

Because disposal of used tyres in landfills presents an increasing environmental problem, legislation at federal, state and local government levels in the US started about 20 years ago to promote, and in some cases mandate, the use of crumb rubber (CR) in asphalt pavements. The most notable of these legislations was the Intermodal Surface Transportation Efficiency ACT (ISTEA) passed by the US Congress in 1991. It mandated that starting in 1994, at least 5% of all asphalt mixtures used for federally funded highway projects be modified with CR. The mandate stated further that each of the following years, usage of CR as asphalt modifier was to be increased by 5%; in 1997 and each year thereafter, at least 20% of all federally funded asphalt paving projects should have included CR as modifier. This legislation caused a sharp increase in interest and in use of CR as asphalt modifier. Because many state transportation departments did not have sufficient experience in CR-modified binder and mix design, and in related asphalt mix production and pavement construction, some of the projects carried out during this period did not meet performance expectations. As a result, the federal mandate of using CR in asphalt pavements was suspended in the Transportation Appropriations Bill of 1995 and funds were set aside to conduct more research on:

a. Test methods and specifications for CR modified asphalt binders and mixtures.
b. Performance properties of asphalt binders and mixtures containing CR.
c. Asphalt mix design using CRMB as binder.
d. Asphalt mix production and pavement construction using CRMB.
e. Project quality control and quality assurance.

US is not only the primary contributor to CR technology development, but is currently also the largest user of CR in asphalt pavements. Until 1992, more than 6 million tonnes of asphalt mix modified with CR was produced and used in pavement construction; since then, usage has been growing, especially in Florida, California, Texas and Georgia, and has now reached in the US more than 15 million tonnes of CR-modified asphalt mixes per year. Most of the CR-modified binder is used in gap-graded mixtures, such as porous asphalt and open-graded friction course. The percentage of CR in bituminous binder used for friction course is typically in the range of 12 to 16%; higher CR dosages are typically used in Arizona. For dense graded asphalt mixtures, low CR dosages are used, ranging from about 3% in Florida to approximately 8% in some other states.

The performance of crumb rubber modified asphalt mixes in the US in 1970s and 1980s are summarised in Table 1 below (extracted from an unknown source).

	STATE	REMARKS
1	Alaska	Pavement sections placed in 1979 – 1983 using dry process (refer to Note below) have superior fatigue resistance but were not as good as conventional in resisting ravelling and pothole formation.
2	Arizona	The longest user of crumb rubber modified mixes. Arizona presently uses dense and open-graded mixes made with asphalt-rubber binders for overlays on existing rigid and flexible pavements.
3	California	After using crumb rubber for more than 20 years, California recommends: i. Asphalt-rubber open-graded mixes should no longer be considered as an experimental technology. ii. Asphalt-rubber dense and gap-graded mixes should be used on an experimental basis. iii. Dry process using devulcanised rubber should not be used.
4	Connecticut	Based on nine-year performance study of asphalt-rubber pavement produced using dry process, Connecticut concludes; i. On thick overlays, 2% crumb rubber increase reflection cracking as compared with control sections. ii. On thin overlays, 1% crumb rubber reduce reflection cracking by two-third. Increased in crumb rubber contents result in more cracking.
5	Florida	All asphalt-rubber dense and open-graded sections performed well since 1989-1990. Beginning in January 1994, all dense and open-graded friction courses require an asphalt-rubber binder.
6	Kansas	Two experimental asphalt-rubber dense-graded sections placed in 1990 showed more reflection cracking.
7	Michigan	Eight experimental sections constructed in 1978-1979 performed poorly in terms of reflection cracking and surface disintegration cracking. Michigan does not recommend the use of crumb rubber modified asphalt.
8	Minnesota	Three experimental sections did not show benefits which offset costs. No future sections were planned until more specific benefits were identified.
9	Mississippi	A test section with 6% devulcanised rubber showed little significant difference in crack pattern, skid resistance and rutting after 2 years as compared with the control section.
10	Oregon	After 5 years, rubber modified section showed better resistance to cracking. However, ravelling in the section was of concern.
11	South Dakota	Dry process rubber modified sections developed some potholes and break-up after 1 year which subsequently developed into large areas of delamination and peeling.
12	Texas	Of two sections, one ravelled shortly after construction while the other performed satisfactorily.
13	Utah	Dry process rubber modified section was removed after 3 years because of severe ravelling.
14	Washington	Five open-graded sections showed good to very good performance. Dry process sections showed poor to average performance.

TABLE 1: United States experiences in crumb rubber.

It was also reported that the Texas Transportation Institute (TTI) has carried out a comprehensive study on dense-graded mixes which TTI claimed that the addition of crumb rubber does not improve the properties of the mixes (source unknown, extracted from LGM's literature review).

Quality of Typical Crumb Rubber in Malaysia

Crumb rubber for use in the laboratory assessments and subsequent field trials in Kuantan was obtained from Jeng Yuan Reclaimed Rubber Sdn. Bhd. This company was established in 1988 with the principal activity in manufacturing and sale of premium quality reclaimed rubber.

During a visit to the factory in Port Klang by JKR and LGM officials in March 2003, it was briefed that its monthly output then was 600 metric tons, 50% of which was exported to countries like Taiwan, Japan, Vietnam, India and Australia. Crumb rubber of mesh 40 (420 μm) appeared to be a major product with a monthly output of approximately 500 metric tons. It was used mainly in the manufacture of moulded rubber products. Finer crumb of mesh 80 (180 μm) was produced in much lesser quantity of 12 metric tons per month as the factory did not have facilities to purposely produce the finer crumb which was mainly used in making shoe soles.

The source for the crumb rubber was rubber buffings and dust which were purchased at 40 sen/kg from various tyre retreading companies. The type of tyre that was retreaded was mainly truck tyres which contain higher proportion of natural rubber as compared to passenger car tyres which are generally made of Styrene-Butadiene synthetic rubber (SBR) or polybutadiene synthetic rubber. The crumb rubber of mesh 40 was then priced at 80 sen/kg.

The typical quality of crumb rubber produced by Jeng Yuan as compared to the Caltrans specification is shown in Table 2 below.

Test Parameter	Caltrans Crumb Rubber	Jeng Yuan Crumb Rubber
Acetone Extract (%)	6 – 16	10.9
Rubber Hydrocarbon (%)	42 – 65	57.0
Carbon Black (%)	28 – 38	28.3
Natural Rubber (%)	22 – 39	n.a.
Ash (%)	< 8.0	3.7

TABLE 2: Chemical composition of Jeng Yuan crumb rubber.

Full-scale Road Trial In Kuantan

Objectives

The objectives of the trial were to compare the performance of dense graded bituminous overlay incorporating crumb rubber modified bitumen with a similar overlay but using conventional penetration grade 80-100 bitumen in mitigating reflective cracking and to assess the durability of porous asphalt incorporating crumb rubber modified bitumen as well as a proprietary modified bitumen produced by Petronas.

Site selection

A site on Route 2, between Section No. 340 and 345, Kuantan bound was proposed by JKR District of Kuantan. The road pavement of the four-lane dual carriageway which was constructed in early 1990s has visibly reached a critical or fail condition over a substantial proportion of its length and rehabilitation was then urgently required. In fact it had been identified by the JKR District of Kuantan to be overlaid by the Federal Road maintenance concessionaire, Road Care Sdn. Bhd. The proposed site was therefore needed to be truncated from the maintenance contract in order to facilitate the construction of the test sections.

Experimental Design

As the incorporation of crumb rubber modified bitumen, as reported elsewhere, can extend the design life for any given overlay thickness, it can also be used to reduce the thickness of overlay of a given design life. However this design approach was not adopted, instead overlay of similar thickness was placed for each type of aggregate gradation used, with or without crumb rubber. The test site was divided into seven test sections as follows.

i. Dense-graded asphaltic concrete, aggregate grading A, with crumb rubber modified bitumen (hereby referred to as R-Dense A), 40 mm thick.
ii. Dense-graded asphaltic concrete, aggregate grading A, with conventional penetration grade 80-100 bitumen (Dense A), 40 mm thick.
iii. Dense-graded asphaltic concrete, relatively fine aggregate grading B, with conventional penetration grade 80-100 bitumen (Dense B), 30 mm thick.
iv. Dense-graded asphaltic concrete, relatively fine aggregate grading B, with crumb rubber modified bitumen (R-Dense B), 30 mm thick.
v. Open-graded porous asphalt, aggregate grading C, with crumb rubber modified bitumen (R-Porous C), 40 mm thick.
vi. Open-graded porous asphalt, aggregate grading C with Petronas modified bitumen (Petronas-Porous C), 40 mm thick.
vii. Open-graded porous asphalt, relatively fine aggregate grading D, with crumb rubber modified bitumen (R-Porous D), 40 mm thick.

Dense B and R-Dense B were to be laid to 30 mm thickness because the maximum nominal size of the aggregate was only 10 mm and pavement surface cracks were expected to appear faster than in the 40 mm thick overlay.

Determination of optimum crumb rubber content

Crumb rubber-bitumen blends with variable content of crumb rubber (CR) were prepared in the laboratory. The quantity of CR added ranged from 0% to 16% at an increment of 4%, by weight of the bitumen.

Dynamic Shear Rheometer testing

Dynamic Shear Rheometer (DSR) is used to characterize the viscous and elastic behaviour of the bitumen. It does this by measuring the complex shear modulus G* and phase angle delta of the bitumen. G* is a measure of the total resistance of the bitumen to deform when repeatedly sheared and it consists of two parts: elastic (recoverable) and viscous (non-recoverable). Delta is an indication of the relative amount of recoverable and non-recoverable deformation.

Non-recoverable or permanent deformation is controlled by limiting G*/sin delta at any test temperature to value greater than 1.0 kPa for fresh or unaged bitumen and 2.2 kPa after aging in Thin Rolling Film Oven Test (RTFOT) or Rolling Thin Film Oven Test (TFOT).

It is this DSR test that was used to determine the optimum content of crumb rubber in the modified binder. Binder grade PG 76 has been specified for the crumb rubber modified binder. As such, samples of the laboratory blend of crumb rubber-bitumen were subjected to DSR test at 76°C. TFOT was used for aging the binders. The tests were carried out at University Malaya.

Referring to Figure 4.3, G*/sin delta of unaged sample equals to 1.0 kPa at crumb rubber content of about 12% whereas Figure 4.4 indicates that G*/sin delta of TFOT-aged sample reaches 2.2 kPa at rubber crumb content of about 17%.The results show that G*/sin delta increases exponentially with increasing crumb rubber content for both unaged and TFOT-aged samples. It was jointly decided by JKR and LGM that crumb rubber content of 16% be used in the road trial in Kuantan.

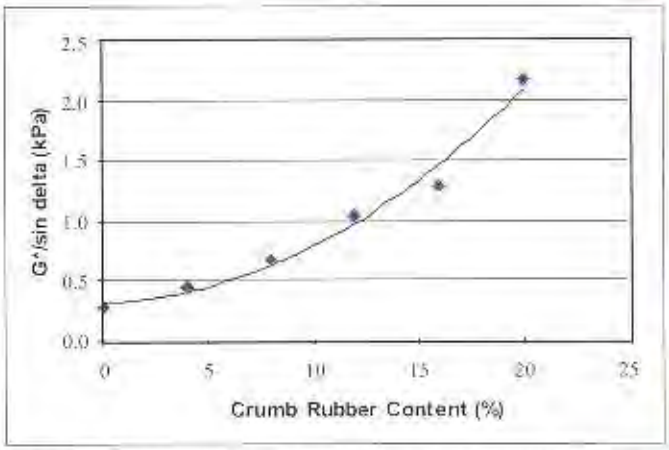

Figure 4.3: Variation of G/sin delta with crumb rubber content for unaged binder.*

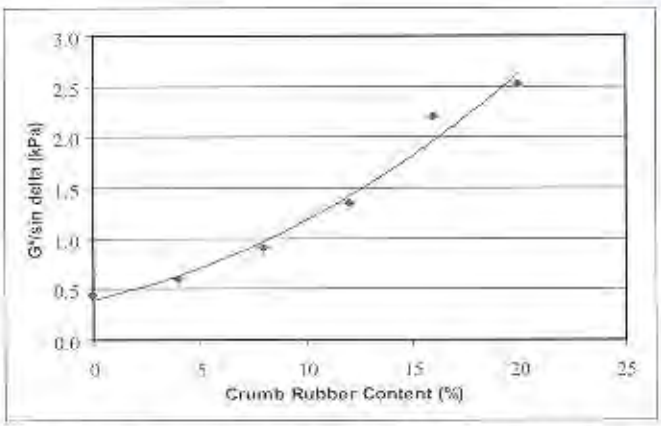

Figure 4.4: Variation of G/sin delta with crumb rubber content for TFOT- aged binder.*

The blend with 16% CR content was subsequently used in the preparation of dense-graded (grading A & B) and open-graded (grading C & D) mixtures at varying binder contents ranging from 4.5% to 7.5%.

Construction

The construction of the trial commenced on 13th June 2003 beginning from test point -10 on the slow lane. As monitoring of the test sections would be confined to the slow lane only, supervision of the construction was carried out on this lane only. The construction of all seven test sections on the slow lane was completed on 30th June 2003.

Photo 1: Paving the test sections.

Photo 2: Bitumen blending system at JKR Kuari Bukit Penggorak.

Discussion

The full-scale road trial in Kuantan provided an opportunity to evaluate the performance of crumb rubber modified bituminous overlay in mitigating reflective cracking, the most widely reported benefit of using crumb rubber as bitumen modifier. The presence of crumb rubber in the bitumen improves significantly the binder resistance to oxidative aging. Some components of crumb rubber have lower activation energy than bitumen, while other components act as anti oxidant. The components with low activation energy react more rapidly with oxygen than bitumen. This influences positively the aging behaviour of the modified binder, because the product of rubber-oxygen reaction is less detrimental to the binder and mixture performance than is the product of bitumen-oxygen reaction. Overall hardening of the binder is,

therefore, slowed down significantly by the presence of crumb rubber. The effect of aging is further reduced by the presence of carbon black, which is an anti-oxidant, and by the typically thicker binder films of crumb rubber-modified asphalt mixtures. Despite its being more viscous and higher stiffness, failure strain of properly formulated and produced crumb rubber modified binder is larger than that of conventional bitumen, thus increasing also resistance to crack initiation and propagation.

With extensive cracking in the underlying layer, high traffic loading and relatively thin cosmetic overlay (40 mm), it was anticipated that the cracks would propagate into the new overlay within a relatively short period of time. Even a thinner overlay (30 mm) was included in the test sections in order to expedite further the impending appearance of reflection cracks on the surface of the new overlay so that the comparison of performance between the test sections with and without crumb rubber could be made after a shorter period of time.

The approach adopted in the design of thickness of the new overlay was that a similar thickness was specified for both test sections with and without crumb rubber rather than reducing the thickness of the overlay modified with crumb rubber accordingly such that a design life similar to the overlay without crumb rubber was achieved.

With the possibility of thicker film of binder having improved resistance to oxidative aging, the crumb rubber modified binder was also used in the construction of porous asphalt test sections.

The other benefit that is normally associated with the use of crumb rubber as bitumen modifier is improved resistance to rutting of overlay due to the presence of the more viscous modified binder. However, as the test sections were located on a relatively flat terrain, the overlay was not expected to be subjected to high traffic loads at extremely long loading times which would be normally associated with slow moving heavy commercial vehicles. Under such extreme conditions, the binder would behave in a more viscous manner, allowing the bituminous mixture to flow under the high traffic stresses. The progression of surface deformation along the wheelpaths was therefore not monitored in this trial.

Periodic monitoring on the formation of surface cracks in the dense mixture test sections and ravelling in the porous asphalt test sections was carried out by manual observation and this was confined to the slow lane only where most of the heavy vehicles would be travelling on.

The presence of cracking and ravelling were recorded as percentage of the total area within each test section. Table X below shows these results for all the test sections which were obtained at various time intervals after construction.

There is an indication that the presence of crumb rubber in asphalt mixtures could significantly mitigate the propagation of cracks from underlying layers through relatively thin overlay with relatively fine aggregate gradation. This was shown by considerably less percentage of cracks that was reflected. However, with coarser aggregate gradation and thicker overlay, the crumb rubber does not appear to impart appreciable improvements in resistance to reflective cracking as it was observed that both sections with and without crumb rubber were performing equally well after 52 months of monitoring. The extra cost incurred by the addition of crumb rubber to the road surfacing material would not be justifiable if significant improvements could not be attained. Further monitoring of the test sections is recommended to ascertain that appreciable improvements as in the thin overlay could be achieved in the thicker overlay after a longer time period.

It was also observed that there was no ravelling in all three porous asphalt test sections. This could be attributed to the relatively thick film of binder coating the aggregates due to the presence of crumb rubber in the R - Porous C and R - Porous D test sections and proprietary additive in the Petronas - Porous C test section.

Mix Types	Time After Construction (months)								% of Initial Cracked Area at Month 52
	Percentage Area of Cracking								
	Initial (before constr.)	0.5	3	6	12	18	30	52	
R-Dense A	52.5	0	0	0	0	2.8	5.8	6.0	11.4
Dense A	44.8	4.5	4.5	4.5	5.0	5.0	7.0	7.2	16.1
Dense B	14.3	5.0	5.0	5.0	6.0	6.0	8.0	12.0	83.9
R-Dense B	12.0	0	0	0	0	0.8	2.0	3.2	26.7
	Percentage Area of Ravelling								
R-Porous C	3.0	0	0	0	0	0	0	0	0
R-Porous D	1.5	0	0	0	0	0	0	0	0
P-Porous C	1.5	0	0	0	0	0	0	0	0

CONCLUSIONS

i. The presence of crumb rubber in the road surfacing dense material appear to impart appreciable improvements on resistance to reflective cracking in relatively thin overlay with relatively fine aggregate gradation. However, similar improvements could not be ascertained in thicker overlay with coarser aggregate gradation as it was observed that the section with crumb rubber performed only slightly better than the section without crumb rubber after 52 months.

ii. With properly designed dense graded asphalt mixture using coarser Superpave aggregate gradation, the overlay appears to have the ability to resist reflective cracking even without crumb rubber additive.

iii. There was no ravelling in all three porous asphalt test sections. This could be attributed to the relatively thick film of binder coating the aggregates and improved resistance to oxidative aging of the binder due to the presence of crumb rubber in the R - Porous C and R -

Porous D test sections and proprietary additive in the Petronas - Porous C test section.

iv. The addition of 16% crumb rubber to penetration grade 80-100 bitumen reduces the penetration value by 2 grades. However, the softening point merely increases marginally from a normal range of 45 - 52 °C to 56 °C.

v. The ductility is significantly reduced from over 100 cm, a requirement for penetration grade 80-100 bitumen, to about 27 cm with an addition of 16% crumb rubber.

vi. PG 76 binder could be achieved by adding 16% crumb rubber from truck tyre buffing to penetration grade 80-100 bitumen.

vii. The crumb rubber obtained locally from Jeng Yuan Reclaimed Rubber Sdn. Bhd. in Port Klang which was produced by grinding rubber buffing from truck tyres did comply with California Department of Transports specification for chemical composition of crumb rubber.

Recommendations

i. LGM should proceed in developing better forms of rubber for use as bitumen additive, whether it is to be applied in the dense-graded or open-graded asphalt, as crumb rubber from rubber buffing of truck tyres would not be a good proposition and would definitely not resolve the problem in disposing the abundant used car tyres in this country. If natural rubber latex could be developed by LGM as cost-effective bitumen additive, it is envisaged that the impact to the Malaysia rubber industry would be more pronounced.

ii. The rubber modified binder and asphalt mixes should be subjected to laboratory testing such binder elastic recovery, indirect tensile fatigue and resilient modulus for some indications of improved resistance to reflective and surface cracking of dense-graded asphalt mixes prior to trial application on the roads.

iii. Crumb rubber modified binder in dense asphalt mixtures should be equivalent to Type II asphalt rubber as specified in California. This blend should contain 75% rubber from scrap tyres and 25% rubber from high natural rubber resources.

iv. The scrap tyres should consist of ground rubber derived from tyre buffing of truck tyres whereas the high natural rubber should be ground rubber derived from materials that utilise high natural rubber resources.

v. Based on California Department of Transports, the properties of the rubber from scrap tyres and high natural rubber resources should be as follow:

Test Parameter	Crumb Rubber	High Natural Rubber
Acetone Extract (%)	6.0 – 16	4.0 – 16
Rubber Hydrocarbon (%)	42 – 65	< 50
Carbon Black (%)	28 – 38	-
Natural Rubber (%)	22 – 39	40 – 48
Ash (%)	< 8.0	-

vi. Performance graded binder should be used as a basis for specification of the crumb rubber modified bitumen.

vii. PG 76 should be the target for crumb rubber modified bitumen formulation and production for use in either dense or open graded asphalt mixtures.

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Tips

TIPS: Possible causes of imperfections in newly constructed asphalt road surfacing

Types of pavement imperfections that may be encountered in laying asphalt mixtures	Inadequate or non uniform tack coat	Improperly cured prime or tack coat	Mixture too coarse	Excess fines in mixture	Bitumen content too low	Bitumen content too high	Improperly proportioned mixture	Unsatisfactory batches in load	Excess moisture in mixture	Mixture too hot	Mixture too cold	Poor paver operation	Paver in poor condition	Inadequate rolling	Over-rolling	Rolling when mixture too hot	Rolling when mixture too cold	Roller standing on hot pavement	Overweight rollers	Too high amplitude – vibratory roller	Improper frequency – vibratory roller	Vibration when reversing or stopped	Over-rolling – vibratory roller	Excess moisture in unbound layers	Excessive prime coat or tack coat	Excessive hand raking	Unskilled worker	Excessive segregation in laying	Operating finishing machine too fast
Bleeding						x	x	x																	x				
Dry appearance					x				x	x																			
Rich spots						x	x	x																	x			x	
Poor surface texture			x	x			x	x			x	x	x	x	x	x	x									x	x	x	x
Rough uneven surface	x	x	x				x	x			x	x	x	x		x	x	x	x	x	x	x	x			x	x	x	x
Raveling			x				x	x			x	x	x	x			x									x	x	x	
Uneven joints			x		x						x	x	x	x		x	x									x	x	x	
Roller marks				x		x	x				x			x		x	x	x	x			x	x				x		
Shoving or waves	x	x		x		x	x	x	x			x	x			x			x				x			x			
Many fine cracks				x	x		x								x	x			x	x			x	x					
Large long cracks															x				x				x	x					
Aggregate crushing			x				x				x	x	x		x	x			x	x		x	x						
Surface tearing			x		x		x			x	x	x	x															x	x
Surface slipping	x	x		x		x	x		x		x			x	x		x		x	x			x	x	x				

Excerpt from The Asphalt Institute Specification Series No.1, November 1984

International Seminar on Stone Mastic Asphalt

The turnout for the INTERNATIONAL SEMINAR ON STONE MASTIC ASPHALT, held on 13 March 2008 at the Holiday Inn Glenmarie, Shah Alam, Selangor was beyond the organisers' expectations. JKR and REAM Technical Committee 4 – Pavement jointly organised this seminar with the support of Hanson Heidelberg Cement Group, Innopave, JRS and Shell. It was graciously officiated by Y.Bhg. Dato' Ir. Haji Mohamad bin Husin, the Deputy Director of Works (Business Sector) who is also the Deputy President of REAM. The seminar brought together researchers and practitioners from Europe, China, Australia, Korea, Singapore and Malaysia, who shared with the participants their experiences and state-of-the art practices in SMA applications in their respective countries. The speakers for this seminar were **Mr. Jiik Lee,** General Manager, Insung Co. Ltd. Korea; **Mr. Horst Erdlen,** Business Unit Manager, J. Rettenmaier & Sohne Gmbh+Co Kg, Germany; **Dr. Low Boon Hwee,** National Technical Manager (S'pore & M'sia), Hanson Quarry Products Sdn Bhd, Malaysia/Singapore; **Mr. Nigel Preston,** Bitumen Technical Manager – Oceania, Shell Australia Limited, Australia; **Prof. Wang Shao Huai,** Lecturer & Researcher, South China University of Technology, China; **Assoc. Prof. Dr. Ratnasamy Muniandy,** Lecturer, Universiti Putra Malaysia, Malaysia and **Dr. M.A. Shahid,** Principal Pavement Specialist, Opus International (M) Berhad, Malaysia. The knowledge gained from this seminar will assist the participants in applying the Stone Mastic Asphalt surfacing correctly and effectively.


Conventional Asphalt


Stone Mastic Asphalt

Seminar Road Asset Management di Delhi

Seramai 14 orang peserta yang terdiri dari kakitangan Jabatan Kerja Raya Malaysia, konsesi (*Selia Selenggara Selatan*), kontraktor (*Bina Puri Construction Sdn. Bhd.*) dan Plus Expressway Berhad telah menyertai delegasi REAM ke Seminar Antarabangsa *PIARC Road Asset Management* di Chandigarh dan Lawatan Sambil Belajar di Delhi, India dari 17 hingga 22 Mac 2008.

Seminar ini adalah anjuran bersama Technical Committee 4.1 – Asset Management dan World Road Association (PIARC) dan telah disertai oleh delegasi dari pelbagai negara di seluruh dunia. Seramai 19 orang penceramah dari Sweden, Denmark, Malaysia, United Kingdom, India, Afrika Selatan, Hungary, Australia, Perancis dan Israel / World Bank telah dijemput untuk menyampaikan maklumat dan berkongsi pengalaman dalam pengurusan aset jalan di negara masing-masing. Dua orang penceramah telah dijemput dari Malaysia iaitu Ir. Dr. Safry Kamal Hj. Ahmad (Pengarah, Cawangan Senggara Fasiliti Jalan, JKR) dan En. Chin Chi Haw (Group General Manager, Business Development Division, Opus Group Berhad). Cawangan Senggara Fasiliti Jalan turut diwakili oleh Ir. Shafii Mohamad, Ir. Ibrahim Esa, Ir. Mohd Fauzi Junus dan Jazlina Nor Sarif.

Objektif utama seminar ini adalah untuk mengenalpasti kaedah yang digunakan oleh pelbagai negara dalam mengkoordinasi dan mengurus aset jalan di samping berkongsi pendapat dan teknologi di kalangan ahli PIARC dalam membangunkan sistem pengurusan aset jalan yang lebih baik dan terkini.

Lawatan teknikal ke Sydney

Satu lawatan teknikal ke Sydney, Aystralia telah diadakan pada 11 – 16 Februari 2008. Rombongan disertai oleh Y.Bhg. Dato' Ir. Dr. Azmi Hassan (Pengarah Cawangan Jalan), Ir. Aishah Othman (Cawangan Kejuruteraan Jalan dan Geoteknik), Ir. Abdul Mutalif Abdul Hameed (Cawangan Kerja Pendidikan) dan Ir. Mohd Hizam Harun (Cawangan Senggara Fasiliti Jalan). Objektif lawatan ini, yang dibiayai oleh Road Engineering Association Malaysia (REAM), ialah untuk memberi pendedahan kepada ahli rombongan ke atas pelbagai jenis teknologi pavemen jalan yang diguna pakai secara meluas di New South Wales, Australia dengan tujuan menambah baik spesifikasi kerja jalan JKR. Di antara teknologi yang sempat ditinjau ialah subgrade stabilisation, sprayed seal dan stone mastic asphalt.

VISI

Cawangan Senggara Fasiliti Jalan

"Menjadi pusat kecemerlangan senggara fasiliti jalan berteraskan kreativiti dan inovasi modal insan serta teknologi terkini"

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